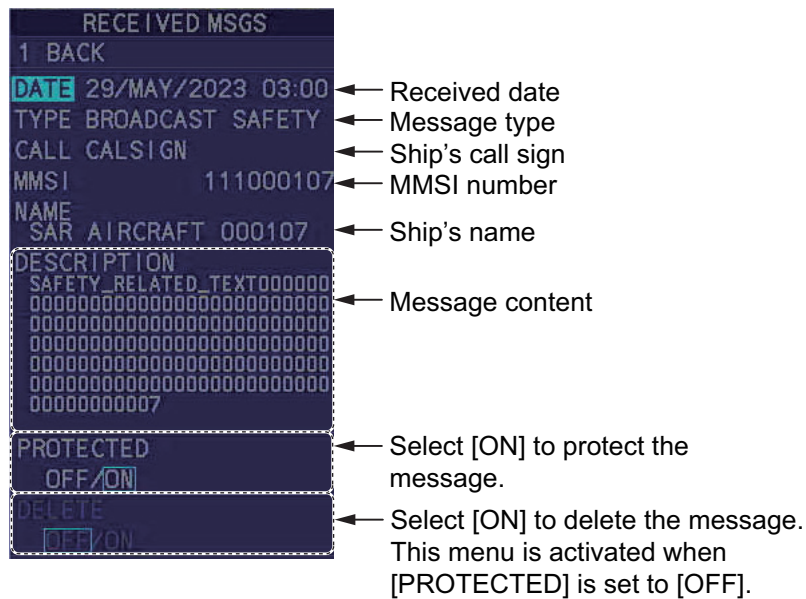


How to filter the message list

When you want to filter the message list, use the filter setting on the top of the message list.

- Upper filter setting:
 - [ALL]: Show all received messages.
 - [TARGET]: Show only the AIS message from the AIS-equipped ships, SAR aircrafts and AIS base stations.
 - [SART]: Show only the AIS message from the SART.
 - [ATON]: Show only the AIS message from the AtoN.
 - Lower filter setting:
 - [ALL]: Show all received messages.
 - [ADDRESSED]: Show only the addressed messages.
 - [BROADCAST]: Show only the broadcast messages.
 - [PROTECTED]: Show only the protected messages.
 - [UNREAD]: Show only the unread messages.
5. Select the message to be displayed, then left-click.
The message details are displayed.



6. Close the menu.

4.17.4 How to set up the AIS message notification

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [3 AUTO DISP MESSAGE].
5. Select [ON] to show the received message indication (blue envelope icon) when a new message is received, [OFF] to disable the notification.
6. Close the menu.



No unread messages, or [3 AUTO DISP MESSAGE] is set to [OFF].

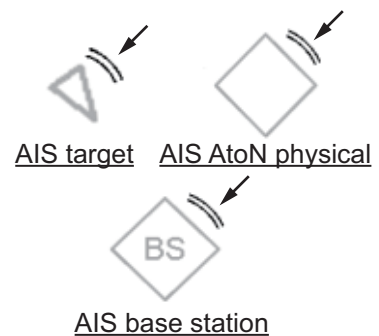


[3 AUTO DISP MESSAGE] is set to [ON] and at least one unread message is stored.

4.17.5 How to show the unread message symbols

Do as follows to show the unread or viewing AIS message symbols.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [9 UNREAD MSG SYMBOL].
5. Select [ON] to show the unread or viewing AIS message symbols.
6. Close the menu.



4.17.6 How to mark the AIS messages as read

Do as follows to mark the unread AIS messages that meet the criteria as read.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [8 MESSAGE OPTION].
5. Select [2 MARK AS READ].
6. Select the criteria to mark the messages as read, then select [YES].
 - [TARGET]: Mark all messages received from the AIS-equipped ships, SAR aircrafts and AIS base stations as read.
 - [ATON]: Mark all AIS AtoN messages as read.
 - [SART]: Mark all AIS-SART messages as read.
 - [ADDRESSED]: Mark all addressed messages as read.
 - [BROADCAST]: Mark all broadcast messages as read.
7. Close the menu.

MESSAGE OPTION	
1	BACK
2	MARK AS READ
	TARGET/ATON/SART
	ADDRESSED/BROADCAST
	NO/YES
3	DELETE RECEIVED MSGS
	TARGET/ATON/SART
	ADDRESSED/BROADCAST
	NO/YES

4.17.7 How to delete the AIS messages that meet the criteria

Do as follows to delete the AIS messages that meet the criteria.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [8 MESSAGE OPTION].
5. Select [3 DELETE RECEIVED MSGS].
6. Select the criteria to mark the messages as read, then select [YES].
 - [TARGET]: Delete all AIS messages from the AIS-equipped ships, SAR aircrafts and AIS base stations.
 - [ATON]: Delete all AIS AtoN messages.
 - [SART]: Delete all AIS-SART messages.
 - [ADDRESSED]: Delete all addressed messages.
 - [BROADCAST]: Delete all broadcast messages.
7. Close the menu.

4.18 AIS System Messages

AIS system messages are displayed at the bottom right corner of the screen. The table below shows the AIS system messages, their alert priority and their meanings.

Message	Priority	Meaning
CPA/TCPA	Alarm	CPA and TCPA of an active AIS target are below value set on the menu.
AIS NEW TARGET	Warning	AIS object has entered an acquisition zone.
AIS TARGET LOST	Warning	Lost object. An AIS target is declared a lost object when it fails to produce data for six minutes or five reporting intervals, whichever is the shorter.
AIS ATON LOST	Warning	Data not input from AIS AtoN for a specified period.
AIS SART LOST	Warning	Data not input from AIS SART, AIS MOB, EPIRB-AIS for a specified period.
AIS DISPLAY FULL	Warning	The radar only displays the closest 350 AIS targets from own ship.
ACTIVE AIS FULL	Warning	Number of active AIS targets has reached 50.
AIS DATREP FULL	Caution	Number of AIS data reports has reached 50.
AIS SART FULL	Caution	Number of AIS locating devices has reached 20.
AIS SYN TGT FULL	Caution	Number of AIS synthetic targets has reached 50.
LOST AIS COM	Warning	Not receiving AIS data from own AIS (VDO message). Note: When no AIS data is received, the message "AIS COM ERROR" appears in the Alert Box. Check connection with the AIS transponder. When the AIS function is disabled: Above message is prioritized as a Caution level alert for IMO/A/R-types. B/W-types do not show this alert. When the AIS function is active: Above message is prioritized as a Warning level alert for all radar types.
AIS CAPACITY 95%	Caution	Number of AIS targets has reached 1140. (Appears for R-types only.)
AIS CPTY FULL	Caution	Number of AIS targets has reached 1200. (Priority is set to Warning for R-types.)
AIS DISPLAY 95%	Caution	Number of displayed AIS targets has reached 333.
ACTIVE AIS 95%	Caution	Number of active AIS targets has reached 48.
AIS MSG SEND ERR	Caution	Could not send AIS message.

4.19 Risk Visualizer™

The Risk Visualizer™ function identifies AIS targets (and TT) which may be on collision course with own ship. See section 3.20 for details.

5. VIDEO PLOTTER OPERATION

The video plotter has the following functions:

- Enter waypoints (up to 198) and marks.
- Creates and displays radar maps.
- Own ship track plotting.
- Display charts and chart-related information (requires a valid chart card).

5.1 Orientation Modes

Six orientation modes are available: [HEAD UP RM], [STAB HEAD UP RM],[STERN UP RM], [COURSE UP RM], [NORTH UP RM], [NORTH UP TM] (True Motion).

Note 1: The [STERN UP RM] orientation mode is only available if it has been set to [ON] in [STERN UP RM] in the [INITIAL SETTING] → [OPERATION] menu.

Note 2: The screen may flash when the heading is changed more than one degree in the [HEAD UP RM] or [STAB HEAD UP RM] mode.

Automatic resetting of own ship mark in true motion mode

In the true motion mode, the own ship mark is automatically returned stern-ward 75% from the screen center when it reaches a location 50% of the display radius.

To select an orientation mode, see section 1.30.

Marks can be entered at any location inside the operational display area, however, no mark can be entered at the location of an on-screen box. A total of 20,000 marks can be inscribed at any one time.

5.2 How to select a mark type

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [5 RADAR MAP].
The [RADAR MAP] menu appears.
Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [3 MARK TYPE].
5. Select the appropriate type of marker, referring to the list below.
 - [ORIGIN MARK(No.)]: Inscribes the standard origin mark symbol (◇), with mark number (1 to 10). For detailed information regarding origin marks, see section 5.5.

RADAR MAP (1/2)	
1 BACK	
2 ORIGIN MARK STAB	
[GND]/SEA	
3 MARK TYPE	
[ORIGIN MARK(No.)]/	
ORIGIN MARK(SYM)/	
MAP MARK/	
WP 1~ 50/	
WP 51~100/	
WP101~150/	
WP151~198/	
OWN SHIP SHAPE	
4 MARK POSITION	
[CURSOR]/OS/L/L	
*****N	
*****E	
RADAR-MAP	20/20000
OWN TRACK	41/20000
0 NEXT	

5. VIDEO PLOTTER OPERATION

- [ORIGIN MARK(SYM)]: Inscribes an origin mark symbol, with no mark number. You can set one of the following symbols as the origin mark. See section 5.5 for details.



- [MAP MARK]: Inscribes the selected map mark.
 - [WP1-50], [WP51-100], [WP101-150], [WP151-198]: Inscribes a waypoint marker number within the selected range. For detailed information regarding waypoints, see section 5.9.
 - [OWN SHIP SHAPE]: Inscribes a mark with the same shape as own ship. For detailed information regarding the own ship mark, see section 5.6.
6. Close the menu.

5.3 How to select the mark inscription position

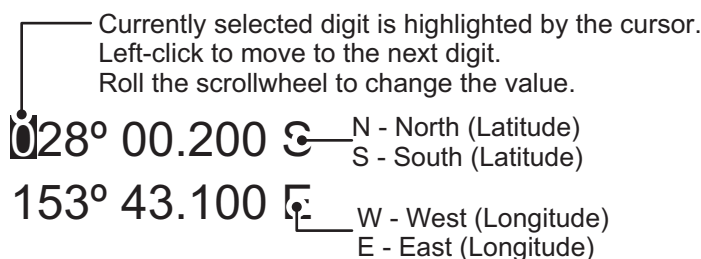
You can select the location at which the marker is inscribed.

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [5 RADAR MAP].
The [RADAR MAP] menu appears.
Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [4 MARK POSITION].
5. Referring to the table below, select the appropriate location.

Location	Description
[CURSOR]	You can select the location using the Control Unit.
[OWN SHIP]	Marker is placed at own ship position.
[L/L]	Marker is placed at the co-ordinates selected.

How to set the co-ordinates

Where [4 MARK POSITION] is set to [L/L], the co-ordinates settings are displayed. Co-ordinates can be set one digit at a time, as shown in the figure below.



- 1) Spin the scrollwheel to change the value, then left-click to move to the next digit.
 - 2) Repeat step 1 to adjust the Latitude and Longitude as appropriate.
6. Close the menu.

5.4 Radar Map

A radar map is a combination of map lines and symbols whereby the user can define and input the navigation data, route planning and monitoring data. The radar map can contain 20,000 points of data. Inscribed marks are retained when the power is turned off.

The radar map is referenced to the WGS-84 datum and appears only when there is valid position data input. The radar map does not affect any radar functions.

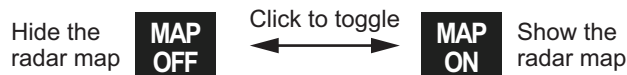
Note: The location and orientation of mark symbols and mark lines can change, depending on the display presentation mode, as shown in the table below.

Presentation mode	Mark symbol	Mark line
HEAD UP RM STERN UP RM STAB HEAD UP RM	Location is changed according to heading and own ship position. Orientation is unchanged.	Location and orientation are changed according to heading and own ship position.
COURSE UP RM NORTH UP RM NORTH UP TM	Location is changed according to own ship position. Orientation is unchanged.	Location and orientation are changed according to own ship position.

5.4.1 How to show/hide radar map marks

You can show or hide marks on the radar map.

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [5 RADAR MAP].
The [RADAR MAP] menu appears.
Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [0 NEXT] to show the next menu page.
5. Select [2 MAP DISPLAY].
6. Select [ON] or [OFF] as appropriate.
Note: You can also show/hide the radar map marks from the Radar Map button on the InstantAccess bar™.



7. Close the menu.

5.4.2 How to select the mark color (B/W-type only)

type radars of this series allow the change of mark colors. For all other types, the color is fixed and cannot be changed.

1. Open the menu.
2. Select [2 MARKS].
For B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [5 RADAR MAP].
The [RADAR MAP] menu appears.
Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [0 NEXT] to show the next menu page.
5. Select [3 MARK COLOR].
6. Select the appropriate color. Available options are shown in the table below.

Menu indication	Color	Menu indication	Color	Menu indication	Color
RED	Red	CYA	Cyan	BLU	Blue
GRN	Green	MAG	Magenta	YEL	Yellow
WHT	White				

7. Close the menu.

5.4.3 How to inscribe marks

You can inscribe marks anywhere inside the operational display area, however, marks cannot be inscribed in the same location as a menu box.

Depending on the setting for [4 MARK POSITION] the method to inscribe a mark is slightly different.

Where [4 MARK POSITION] is set to [CURSOR]

1. Referring to section 5.2, select the mark type you want to use.
2. Place the cursor on the [MARK] box, at the bottom-left of the screen.
3. Spin the scrollwheel to select the appropriate mark, then left-click. The cursor moves inside the operational display area.
4. Place the cursor on the location (inside the operational display area) you wish to inscribe the mark, then left-click to anchor the mark.
5. Repeat steps 3 to 4 for multiple mark inscription.
6. Right-click to complete the procedure.

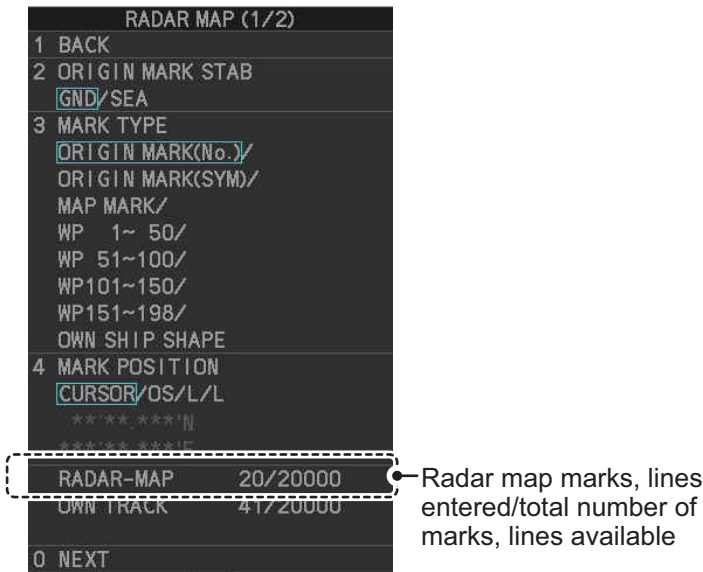
Where [4 MARK POSITION] is set to [OWN SHIP]

1. Referring to section 5.2, select the mark type you want to use.
2. Place the cursor on the [MARK] box, at the bottom-left of the screen.
3. Spin the scrollwheel to select the appropriate mark, then left-click. The selected mark is inscribed at the OS position.
4. Repeat steps 1 to 2 for multiple mark inscription, or right-click to complete the procedure.

Where [4 MARK POSITION] is set to [L/L]

- 1. Referring to section 5.2, select the mark type you want to use.
- 2. Place the cursor on the [MARK] box, at the bottom-left of the screen.
- 3. Spin the scrollwheel to select the appropriate mark, then left-click. [RADAR MAP] menu appears and the first digit of the latitude is selected.
- 4. Referring to section 5.3, set the latitude and longitude.
- 5. Repeat steps 1 to 3 for multiple mark inscription, or right-click to complete the procedure.

Note: You can see the number of radar map marks, lines used, on the [RADAR MAP] menu: [MENU] → [2 MARKS*] → [5 RADAR MAP].



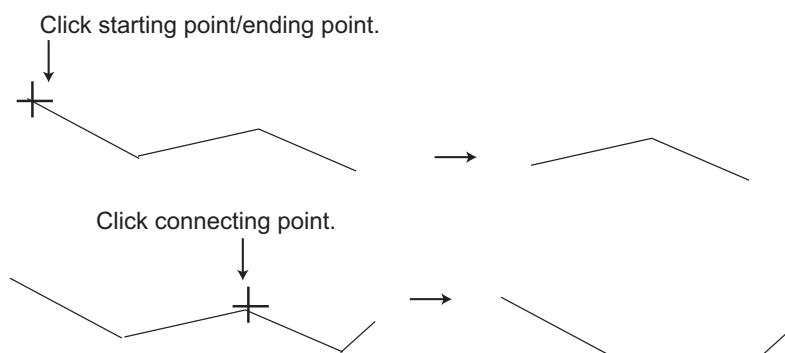
*: Appears as [2 MARKS•CHART] for A/B/W-types with Radar Plotter functionality.

5.4.4 How to delete marks

Marks can be deleted one at a time, or all at once.

How to delete marks individually

1. Select the operational display area, then right-click to show the [CURSOR] context menu.
2. Select [MARK DELETE]. The cursor changes to a highlighted cursor.
3. Place the highlighted cursor on the mark to be deleted, then left-click.
Note: The position of the cursor determines how lines are deleted. To delete a line segment, put the cursor on the starting point (or end point). To delete consecutive line segments, put the cursor on the connecting point.



4. Repeat step 3 to delete another mark, or press the **right button** to return the cursor to normal function.

How to delete all marks

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [8 DELETE DATA].
4. Select [2 ALL MARKS].
5. Select [YES].
6. Close the menu.

*1: Color selection available for A/B/W-types only.

*2: Shown only on IMO/R-types.

*3: Shown only for B/W-types.

DELETE DATA	
1	BACK
2	ALL MARKS NO/YES
3	ALL WAYPOINTS NO/YES
4	ALL NAV LINES NO/YES
5	OS TRACK-COLOR/TIME RED/GRN/BLU/YEL/ CYA/MAG/WHT/30%/ 50%/80%/ALL
6	TGT TRACK-COLOR/TIME RED/GRN/BLU/YEL/ CYA/MAG/WHT/30%/ 50%/80%/ALL
7	OS TRACK-AREA 2POINTS/AREA
8	TGT TRACK-AREA 2POINTS/AREA

*1 { 5, 6 }
 *2 { 6 }
 *3 { 7, 8 }

5.4.5 How to align the radar map

When there is positional error between the radar screen and radar map marks and lines, do the following to correct it.

1. Right-click the operational display area to show the [CURSOR MENU].
You can also place the cursor in the operational display, then spin the scrollwheel to show [MAP ALIGN L=OFF / EXIT] in the guidance box, then left-click.
2. Select [MAP ALIGN]. The cursor is now highlighted and the [MAP ALIGN] function is active.
3. Left-click the map at the location you want to move. The map is now “anchored” to the cursor.
4. Move the cursor to align the radar map with the radar screen, then left-click. The indication "MAP ALIGN" appears on the right side of the operational display area.
5. Right-click to deactivate the [MAP ALIGN] function.

Display indications affected by map alignment

The following items are also re-aligned when the [MAP ALIGN] function is activated.

- | | |
|------------------------------------|---|
| • Map marks | • MOB marks |
| • Drop marks | • Own ship tracks |
| • Anchor watch settings | • Latitude/Longitude Grid |
| • Target tracks | • AIS symbol vector display |
| • AIS symbols | • Zoom window display (STAB GND mode only) |
| • EBL offsets (STAB GND mode only) | • Cursor position coordinates (when CURSOR L/L ALIGN is set to [ON] only) |
| • Origin marks | |
| • NAV lines and waypoints | |

Display indications unaffected by map alignment

The following items are not re-aligned when the [MAP ALIGN] function is activated.

- | | |
|---|-----------------------------------|
| • Radar echoes | • TT symbols |
| • TT symbol vector display | • EBL/VRM reference point |
| • PI lines | • OS coordinates ([POSN]) display |
| • Own ship mark | • Barge mark |
| • Acquisition zone (STAB GND mode only) | |

How to disable the map alignment

1. Right-click the operational display area to show the [CURSOR MENU].
You can also place the cursor in the operational display, then spin the scrollwheel to show [MAP ALIGN L=OFF / EXIT] in the guidance box, then left-click.
2. Select [MAP ALIGN], then left-click. The cursor is now highlighted and the [MAP ALIGN] function is active.
3. Press and hold the **left button**. The "MAP ALIGN" indication is cleared and the map alignment is cleared.
4. Right-click to deactivate the [MAP ALIGN] function.

5.5 Origin Mark

You can mark any prominent target or a point of particular interest using the origin mark feature. When an origin mark is entered, the distance and bearing from the cursor position to the mark are shown at the bottom of the screen, as in the figure below. Twenty origin marks may be entered.



5.5.1 How to inscribe origin marks

The method in which an origin mark is inscribed depends on the setting of [MARK POSITION] (section 5.3). Below are the procedures for each method.

Heading and position inputs are necessary to inscribe an origin mark.

Where [4 MARK POSITION] is set to [CURSOR]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].
2. Put the cursor on the [MARK] box at the bottom of the screen.
3. Spin the scrollwheel to select the origin mark to inscribe.
4. Click the [MARK] box.
5. Click the location where to put the origin mark.
The origin mark is inscribed at the location selected. To re-inscribe the origin mark at a different location, click the desired location for the mark.
6. To enter an origin mark at another location, spin the scrollwheel to change the origin mark, then click the desired location for the origin mark.
7. Right click to finish.

Where [4 MARK POSITION] is set to [OWN SHIP]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].
2. Put the cursor on the [MARK] box at the bottom of the screen.
3. Spin the scrollwheel to select the appropriate origin mark, then left-click. The selected mark is inscribed at the OS position.
4. Repeat steps 1 to 2 for multiple origin mark inscription, or right-click to complete the procedure.

Where [4 MARK POSITION] is set to [L/L]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].
2. Put the cursor on the [MARK] box at the bottom of the screen.
3. Spin the scrollwheel to select the appropriate origin mark, then left-click. RADAR MAP menu appears and the first digit of the latitude is selected.
4. Referring to section 5.3, set the latitude and longitude.
5. Repeat steps 1 to 3 for multiple origin mark inscription, or right-click to complete the procedure.

5.5.2 How to set origin mark stabilization

Origin marks can be geographically fixed (ground stabilized) or moving (sea stabilized).

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [5 RADAR MAP].
The [RADAR MAP] menu appears.
Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [2 ORIGIN MARK STAB].
5. Select [GND] or [SEA] as appropriate.
6. Close the menu.

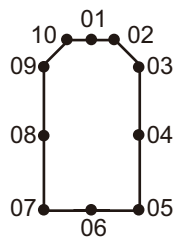
5**5.5.3 How to delete origin marks**

Unlike other marks, you can only delete origin marks individually. To delete origin marks, follow the procedure below.

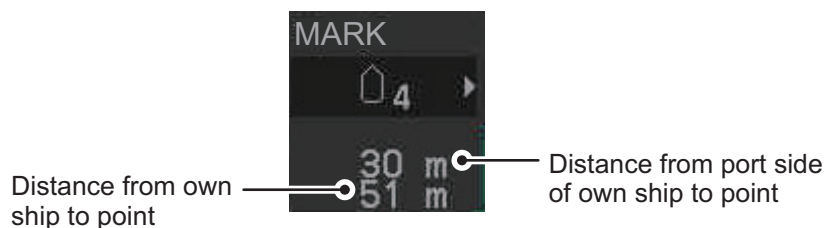
1. Select the operational display area, then right-click to show the [CURSOR] context menu.
2. Select [MARK DELETE]. The cursor changes to a highlighted cursor.
3. Place the highlighted cursor on the origin mark to be deleted, then left-click.
4. Repeat step 3 to delete another origin mark, or press the **right button** to return the cursor to normal function.

5.6 How to Change the Shape of the Own Ship Mark

Ten locations on the own ship mark (section 1.43.4) can be adjusted to depict the shape of own ship more realistically. The ten points are as shown below.



1. Referring to section 5.2, set [3 MARK TYPE] to [OWN SHIP SHAPE].
2. Put the cursor in the [MARK] box at the bottom of the screen.
3. Spin the scrollwheel to select the point no. to change.
The cursor moves to the selected point position.
4. Use the trackball to move the point to the position desired, then click.
Point position information appears in the [MARK] box, as shown in the figure below.



5. Repeat steps 3 to 4 to adjust other points.

5.7 How to Use ECDIS Chart Marks

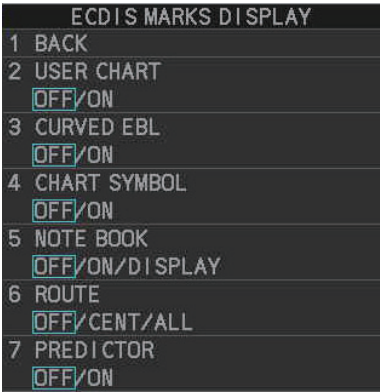
You can display marks received from an ECDIS on the radar screen. If the received mark also contains predicted position data, the predicted position is also displayed on-screen.

Note 1: This function is only available if [ECDIS] is set to [SERIAL] or [LAN] at installation. Consult your dealer for details.

Note 2: The ECDIS chart marks are displayed in the order that they transmitted from the ECDIS. If the display capacity is reached, new marks will not be displayed. It is recommended that the number of marks transmitted from the ECDIS is under the display capacity. The display capacity for the ECDIS chart marks is as follows.

- User chart: 80 objects
- Chart symbol: 80 symbols
- Predictor: 1 data
- Curved EBL: 1 data
- Route: 1 route (6 waypoints are displayed)

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [6 ECDIS MARKS DISPLAY].
4. Select the appropriate item.



- [2 USER CHART]: Shows/hides received user charts.
- [3 CURVED EBL]: Shows/hides the received Curved EBL.
- [4 CHART SYMBOL]: Shows/hides the received chart symbols.
- [5 NOTE BOOK]: Shows/hides the received notes. [ON] shows notes only when they are received. [DISPLAY] shows notes continuously. The notes are shown in the information box at the right-side of the screen.
- [6 ROUTE]: Shows/hides the received route. [CENT] shows only the route line; [ALL] shows both the route line and the route width.
- [7 PREDICTOR]: Shows/hides the received predicted position with a symbol (dotted line) of the same size as the own ship.

Note: Available only when the FEA-2107/2807 is connected.

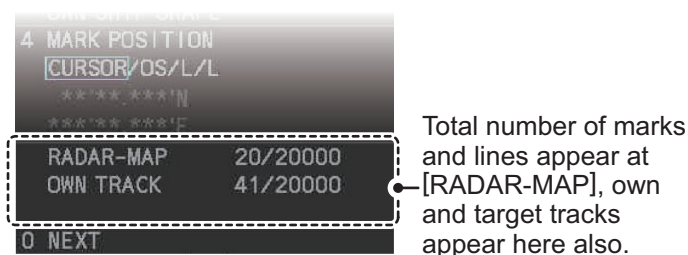
5. Select [ON] or [OFF] as appropriate.
[ON] shows the selected item's ECDIS mark when received, [OFF] hides the ECDIS mark.
6. Close the menu.

5.8 Own Ship and Other Ship's Track

A total of 20,000 points are allotted for storage of own ship's track, marks and lines. For target tracks, the total number of points is 15,000.

When this memory becomes full, the oldest track is deleted to make room for the latest. For that reason you may want to adjust the recording interval to conserve the memory.

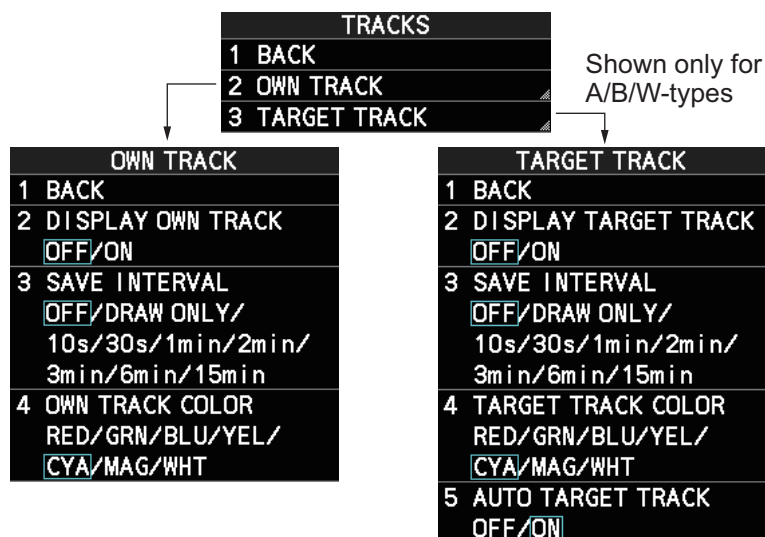
Note: You can check how many tracks are in use from [MAIN MENU] → [2 MARKS*] → [5 RADAR MAP]. (*: For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].)



5.8.1 How to show/hide tracks

You can show or hide tracks for own ship or for targets (A/B/W-types only).

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [7 TRACKS].
4. Select [2 OWN TRACK] or [3 TARGET TRACK] as appropriate.



Note: [3 TARGET TRACK] is available only for A/B/W-type radars.

5. Select [2 DISPLAY OWN TRACK] or [3 DISPLAY TARGET TRACK], as appropriate.
6. Select [ON] to show tracks, or [OFF] to hide tracks.
Note: [3 SAVE INTERVAL] must be set to other than [OFF] to show tracks.
7. Close the menu.

5.8.2 How to set the plotting interval

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [7 TRACKS].
4. Select [2 OWN TRACK] or [3 TARGET TRACK] as appropriate.
Note: For IMO/R-types, [3 TARGET TRACK] is not shown.
5. Select [3 SAVE INTERVAL].
6. Select the appropriate setting, then left-click.

The following tables show the relation between plotting interval settings and maximum track recording time. Note that the maximum recording time is different for own tracks and target tracks.

Own track recording times

Interval	Max. Recording Time	Interval	Max. Recording Time
10 s	56 hours	3 min	1000 hours
30 s	167 hours	6 min	2000 hours
1 min	333 hours	15 min	5000 hours
2 min	667 hours	DRAW ONLY	No track data recorded.

Target track recording times

Interval	Max. Recording Time (One target only)	Max. Recording Time (15 targets)
10 s	42 hours	3 hours
30 s	125 hours	8.5 hours
1 min	250 hours	16.5 hours
2 min	500 hours	33.5 hours
3 min	750 hours	50 hours
6 min	1500 hours	100 hours
15 min	3750 hours	250 hours
DRAW ONLY	No track data recorded.	No track data recorded.

Note: To hide own ship or target past tracks, set the interval to [OFF]. To hide both tracks, set the interval for both own ship and targets tracks to [OFF]. Tracks plotted after the setting is set to [OFF] are hidden. Previously plotted tracks remain on-screen.

7. Close the menu.

5.8.3 How to set the track color (A/B/W-types only)

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [7 TRACKS].
4. Select [2 OWN TRACK] or [3 TARGET TRACK] as appropriate.
5. Select [4 OWN TRACK COLOR]. The following colors are available.
 - [RED] (Red)
 - [GRN] (Green)
 - [BLU] (Blue)
 - [YEL] (Yellow)
 - [CYA] (Cyan)
 - [MAG] (Magenta)
 - [WHT] (White)
6. Select the appropriate setting.
7. Close the menu.

5.8.4 How to automatically plot target tracks (A/B/W-types only)

You can automatically plot target tracks for TT target numbers 001 to 015.

Note 1: [3 SAVE INTERVAL] must be set to other than [OFF] to show tracks.

Note 2: When this feature is active, only the tracks TT targets 001 through 015 are plotted.

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [7 TRACKS].
4. Select [3 TARGET TRACK].
5. Select [5 AUTO TARGET TRACK].
6. Select [OFF] or [ON] as appropriate.
Note: When [5 AUTO TARGET TRACK] is set to [ON], [TARGET TRACK ON] and [TARGET TRACK OFF] are disabled and are not displayed in the [CURSOR] menu.
7. Close the menu.

5.8.5 How to delete tracks

There are three methods to delete tracks: by percentage of track, by track color or by cursor selection.

How to erase tracks by percentage

- 1. Open the menu.
- 2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
- 3. Select [8 DELETE DATA].

Not shown for IMO/R-types.

DELETE DATA	
1	BACK
2	ALL MARKS NO/YES
3	ALL WAYPOINTS NO/YES
4	ALL NAV LINES NO/YES
5	OS TRACK-COLOR/TIME RED/GRN/BLU/YEL/ CYA/MAG/WHT/30%/ 50%/80%/ALL
6	TGT TRACK-COLOR/TIME RED/GRN/BLU/YEL/ CYA/MAG/WHT/30%/ 50%/80%/ALL
7	OS TRACK-AREA 2POINTS/AREA
8	TGT TRACK-AREA 2POINTS/AREA

Color selection available only for A/B/W-types.

Area selection available only for B/W-types.

- 4. Select [5 OS TRACK-COLOR/TIME] or [6 TGT TRACK-COLOR/TIME].
Note: [6 TGT TRACK-COLOR/TIME] is only shown for A/B/W-type radars.
- 5. Select the percentage of the track you wish to delete, then left-click. The available options are: [30%], [50%], [80%] or [ALL].
- 6. Close the menu.

How to erase tracks by color (For A/B/W-types only)

- 1. Open the menu.
- 2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
- 3. Select [8 DELETE DATA].
- 4. Select [5 OS TRACK-COLOR/TIME] or [6 TGT TRACK-COLOR/TIME].
- 5. Select the color of the track you wish to delete, then left-click. The available options are: [RED], [GRN], [BLU], [YEL], [CYA], [MAG] or [WHT].
- 6. Close the menu.

How to erase tracks with the cursor (For B/W-types only)

1. Open the menu.
2. Select [2 MARKS].
For B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [8 DELETE DATA].
4. Select [7 OS TRACK-AREA] or [8 TGT TRACK-AREA].
5. Select [2POINTS] or [AREA] as appropriate, then left-click. The cursor jumps into the operational display area.
[2POINTS]: Delete track between two points. All points between start point to end point change from circle-shaped to square-shaped icons.
[AREA]: Delete all track within an area. Points within the selected area change from circle-shaped to square-shaped icons.



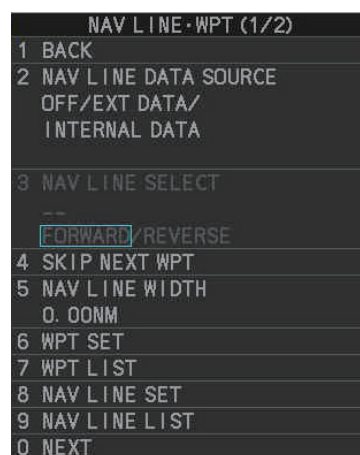
6. Place the cursor on the first point (A), then left-click.
7. Place the cursor on the second point (B), then left-click. If [AREA] was selected at step 5, the two points form a square.
8. Close the menu.

5.9 How to Use Waypoints

A particular location is known as a “waypoint”, whether it be a starting point, a destination point or an intermediate point on a voyage. This radar system can store 200 waypoints. Waypoints 1 to 198 are user set waypoints, waypoint 199 is reserved for external input, waypoint 200 is reserved for MOB (Man Over Board). Waypoints can be entered with the cursor, or from the menu (manual input of latitude and longitude). Waypoints 1 to 198 can be edited from the menu.

5.9.1 How to set the data source for waypoints

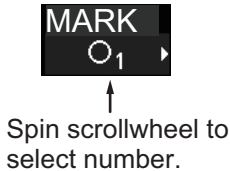
1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [2 NAV LINE DATA SOURCE].
4. Select the appropriate data source, referring to the list below.
 - [OFF]: Waypoints and nav lines (such as tracks) are not shown.
 - [EXT DATA]: Use navigational data from an external EPFS device for waypoints and nav lines.
 - [INTERNAL DATA]: Use waypoints and nav lines saved internally.
 - [WPT MARK] (shown only for A/B/W-type radars): Shows the waypoint marks, however received routes are not shown.
5. Close the menu.



5.9.2 How to enter waypoints

How to enter waypoints with the cursor

- 1. Referring to section 5.2, select the appropriate waypoint number group. The available groups are: [WP1 to WP50], [WP51 to WP100], [WP101 to WP150] or [WP151 to WP198].
- 2. Place the cursor on the [MARK] box. Spin the scrollwheel to select the waypoint number for new waypoint, then left-click. The cursor jumps inside the operational display area.
- 3. Place the cursor on the location to inscribe the waypoint, then left-click.
- 4. Repeat steps 2 to 3 to inscribe other waypoints.
- 5. Right-click the operational display area to complete waypoint inscription.



How to enter/edit waypoints from the menu

Note: Waypoints which are part of a route that is currently in use cannot be edited.

- 1. Open the menu.
- 2. Select [8 NAVLINE•WPT].
- 3. Select [2 WPT SET].
- 4. Select [2 WPT NO. SELECT].
- 5. Spin the scrollwheel, or use the control unit numbered keys, to select a waypoint number.
- 6. **To edit or input a waypoint name**, select [3 WPT NAME], then left-click. The software keyboard appears. Referring to section 1.5.2, name the waypoint.
To skip naming the waypoint, go to step 7.
- 7. Select [4 WPT L/L]. The latitude and longitude settings can now be adjusted.
- 8. Input the latitude and longitude with the number keys, or spin the scrollwheel to select a digit, then left-click to move to the next digit.

WPT SET	
1	BACK
2	WPT NO. SELECT ---
3	WPT NAME
4	WPT L/L --°--'--'- --°--'--'-
5	CLEAR DATA NO/YES



Use the scrollwheel to select a numeral, then left-click. The cursor jumps to to next right place. Repeat to enter the latitude and longitude.

- 9. Close the menu.

5.9.3 How to erase waypoints

There are two methods to erase individual waypoints: cursor selection or from the menu.

How to erase a waypoint by cursor selection

1. Place the cursor inside the operational display area, then right-click.
2. Select [MARK DELETE]. The mark delete function is activated and the cursor is highlighted when inside the operational display area.
3. Select the waypoint you wish to delete, then left-click.
4. Right-click inside the operational display area to deactivate the mark delete function.

How to erase a waypoint from the menu

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [6 WPT SET].
4. Select [2 WPT NO. SELECT]. Then select the waypoint to erase.
5. Select [5 CLEAR DATA].
6. Select [YES] or [NO] as appropriate, then left-click.
7. Close the menu.

How to erase all waypoints

You can erase all waypoints from the menu. If there is an active route, this procedure cannot be completed.

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [8 DELETE DATA].
4. Select [3 ALL WAYPOINTS].
5. Select [YES] to erase all waypoints. Select [NO] to cancel the procedure.
Note: All routes are also deleted with this procedure.
6. Close the menu.

5.9.4 How to display the waypoint list

- 1. Open the menu.
- 2. Select [8 NAVLINE•WPT].
- 3. Select [7 WPT LIST] to show the [WPT LIST].

- Click while on page No.1 to close the list.

- Click while on page No.2 or after to go back on page.

- Long-push the left button to go to page No.1.

WPT LIST (1/40)

1 BACK(L=TOP)

001 WP1

35°20.561'N

139°41.386'E

002 WP2

35°20.257'N

139°41.023'E

003 WP3

35°20.691'N

139°40.494'E

004 WP4

35°21.111'N

139°40.231'E

005 WP5

35°21.509'N

139°40.176'E

0 NEXT(L=LAST)

Displayed page/Total no. of pages

Latitude and longitude position of waypoint

- Go to next page.

- Long-push the left button to go to last page.

- 4. Close the menu.

5.9.5 How to show/hide the waypoint name/number

- 1. Open the menu.
- 2. Select [8 NAVLINE•WPT], then select [0 NEXT] to show the next page.

NAV LINE•WPT (2/2)

1 BACK

2 WPT ARRIVAL DIST

0. OONM

3 TURNING LINE

OFF/ON/REVISED

4 DISPLAY WPT No.

OFF/ON

5 DISPLAY WPT NAME

OFF/ON

- 3. Select [4 DISP WPT NO.] or [5 DISP WPT NAME] as appropriate.
- 4. Select [ON] to show the waypoint name/number, or [OFF] to hide the waypoint name/number, then left-click. he waypoint number and/or waypoint name appear to the right of the waypoint mark.

Waypoint number

Waypoint name

- 5. Close the menu.

5.10 Routes

You can display one route (NAV LINE), which is either received from a connected EPFS device (GPS, etc), or stored internally.

Note: While a route is active, tracks and waypoints cannot be deleted and data cannot be loaded from an SD card.

5.10.1 How to set/edit an internal route

You can store up to 30 routes, each with up to 20 waypoints, in the internal memory.

The procedure for new routes and route editing is the same. To edit a route, you can skip setting other items and only edit the items you wish to change.

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [8 NAV LINE SET]. The [NAV LINE SET] menu appears.
4. Select [2 SELECT NAV LINE].
5. Spin the scrollwheel, or input the number from the keyboard, to assign a number to the route. The input areas for [3 NAV LINE], [4 NAV LINE ENTRY] and [5 CLEAR DATA] become active.
6. Select [3 NAV LINE NAME].
7. Referring to section 1.5.2, assign a name to the route. You can use up to 15 characters in the name.
8. Select [4 NAV LINE ENTRY].
9. Spin the scrollwheel to select a waypoint, then left-click.
10. Repeat step 9 until all waypoints for the route are entered.
When the last waypoint is entered, move the cursor to the next blank input area, then left-click, or assign the last waypoint as "000" using the numeric keys. If 30 waypoints are entered, the setting process for waypoints is automatically completed.
11. Close the menu.

NAV LINE SET			
1	BACK		
2	SELECT NAV LINE		
	02		
3	NAV LINE NAME		
	FURUNO TEST RUN		
4	NAV LINE ENTRY		
	001 -	002 -	003 -
	004 -	005 -	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
5	CLEAR DATA		
	NO/YES		

5.10.2 How to display routes

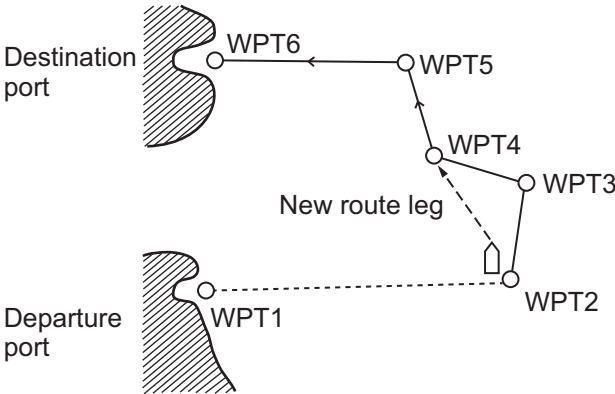
To display internal routes or received routes, follow the procedure below.

1. Open the menu.
2. Select [8 NAV LINE•WPT]. The [8 NAV LINE•WPT] menu appears.
3. Select [2 NAV LINE DATA SOURCE].
4. Select the desired source, referring to the list below.
 - [OFF]: No routes are displayed.
 - [EXT DATA]: Routes received from external sources are displayed.
 - [INTERNAL DATA]: Routes saved in the internal memory are displayed.For [INTERNAL DATA], see step 5; for [EXT DATA], see step 8.
5. Select [NAV LINE SELECT].
6. Spin the scrollwheel to select the desired route number, then left-click.
7. Select the direction you want to navigate the route in.
[FORWARD]: Navigate the route in the direction in which it was created.
[REVERSE]: Navigate the route in reverse of the direction in which it was created.
8. Close the menu.

NAV LINE • WPT (1/2)	
1	BACK
2	NAV LINE DATA SOURCE OFF/EXT DATA/ INTERNAL DATA
3	NAV LINE SELECT -- FORWARD/REVERSE
4	SKIP NEXT WPT
5	NAV LINE WIDTH 0. 00NM
6	WPT SET
7	WPT LIST
8	NAV LINE SET
9	NAV LINE LIST
0	NEXT

How to skip a waypoint

On a voyage similar to the below example, you may want to skip a waypoint to save time. You can skip the next waypoint on the current leg of your route by using the procedure below.



1. Open the menu.
2. Select [8 NAV LINE•WPT]. The [8 NAV LINE•WPT] menu appears.
3. Select [4 SKIP NEXT WPT].
4. Close the menu.

How to set the route width

You can set a width for each route (NAV LINE). For example, if you set a 5 NM route width, the route width is 5 NM to port and starboard, with the own ship as the center. The route width is displayed as orange dotted lines to either side of the route line.

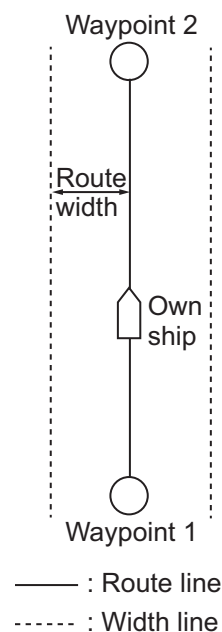
On B/W-type radars, if your vessel deviates from the route and passes the route width, an alert is released and the message "XTD LIM EXCEEDED" appears in the Alert box. To acknowledge this alert, press the **ALERT ACK** key, or click the Alert box.

To set a route width, do the following:

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [5 NAV LINE WIDTH].
4. Spin the scrollwheel, or use the numeric keys, to set a width for the route. To disable the route width alert and hide the route width lines, set the width to [0.00 NM].

Note: This width is applied to all routes.

5. Close the menu.

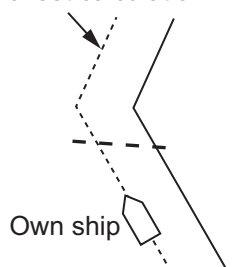


How to show/hide the turning line

You can show or hide the turning line, the point at which your vessel starts a turn in a route.

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [0 NEXT].
4. Select [3 TURNING LINE].
5. Select the appropriate setting, referring to the list below.
 - OFF: Turning line is hidden.
 - ON: Turning line is displayed.
 - REVISED: Turning line is displayed, but offset based on the route and current own ship position.
6. Close the menu.

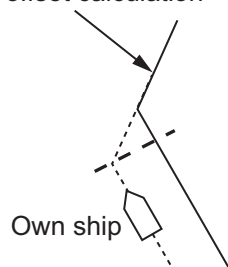
Estimated course with no offset calculation*



[TURNING LINE]
set to [ON]

———— : Route
..... : Track
- - - - : Turning line

Estimated course with offset calculation*



[TURNING LINE]
set to [REVISED]

*: Estimated course is not displayed on-screen.

5.10.3 How to delete internal routes

You can delete a specified route, or all routes.

Note: Active routes and routes from external sources cannot be deleted.

How to delete individual internal routes

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [8 NAVLINE SET].
4. Select [2 SELECT NAV LINE].
5. Spin the scrollwheel, or input the number from the keyboard, to select the route you want to delete.
6. Select [5 CLEAR DATA].
7. Select [YES] to delete the selected route.
8. Close the menu.

How to delete all internal routes

1. Open the menu.
2. Select [2 MARKS].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3. Select [8 DELETE DATA].
4. Select [4 ALL NAV LINES].
5. Select [YES] to delete all internal routes.
6. Close the menu.

5

5.10.4 How to view the routes list

Routes saved to the internal memory can be view by following the procedure below.

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [9 NAVLINE LIST]. The [NAVLINE LIST] appears.

- Click while on page No.1 to close the list.
- Click while on page No.2 or after to go back on page.
- Long-push the left button to go to page No.1.

Displayed page/
Total no. of pages

Route No., Route name

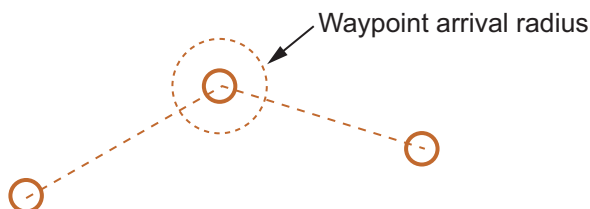
Route waypoints
appear here

- Go to next page.
- Long-push the left button to go to last page.

4. Close the menu.

5.10.5 How to use the waypoint arrival distance function

The waypoint arrival distance function lets you know when you are within a preset distance from the next waypoint. When the waypoint arrival area is set, the next waypoint is shown circumscribed with a dashed orange-colored circle, whose radius is equivalent to waypoint arrival distance setting. When your vessel comes within the destination arrival radius, the system places the arrival radius marker on the next destination.

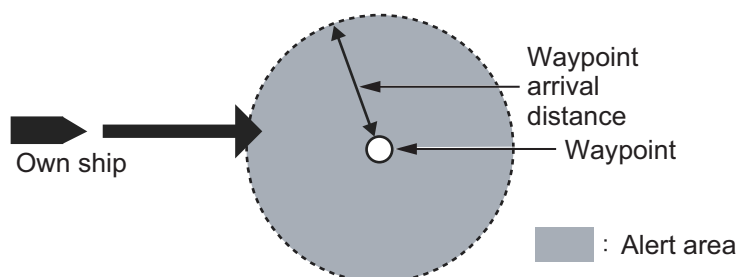


For type radars only, you can also set a waypoint arrival alert.

Note: To use this alert, set [2 NAV LINE DATA SOURCE] in the [NAV LINE•WPT] menu to [EXT DATA] or [INTERNAL DATA] before-hand. See section 5.9.1 for details.

To set and use the waypoint arrival area function, follow the procedure below.

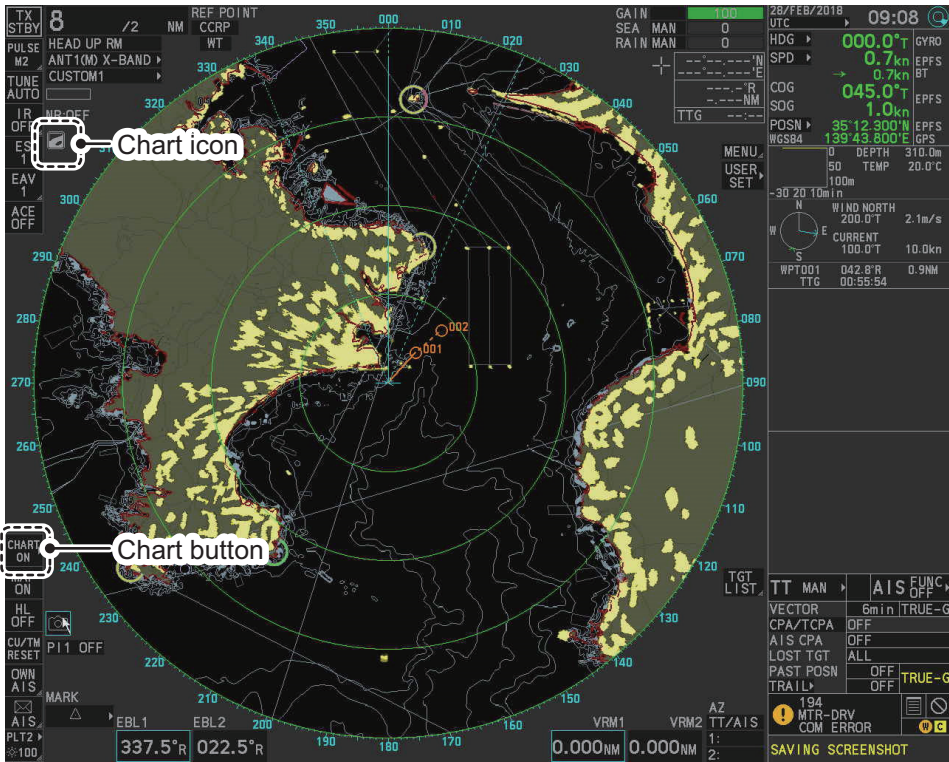
1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [0 NEXT]. The second page of the [NAVLINE•WPT] menu appears.
4. Select [2 WPT ARRIVAL DIST].
5. For B/W-type radars only, select [ON] to enable the arrival alert, or [OFF] to disable the arrival alert.



6. For all radar types, set the width (radius) of the arrival area.
7. Close the menu.

5.11 Chart Functions

Note: All chart functions are available only for A/B/W-types with Radar Plotter functionality.



5

5.11.1 How to show/hide the chart

The [CHART DISPLAY] menu item is [ON] as a factory default. There are two methods to show/hide the chart.

Show/hide the chart using the InstantAccess bar™

Click the Chart button to toggle between [CHART ON] (shows the chart) and [CHART OFF] (hide the chart).



Show/hide the chart from the menu

- 1. Open the menu.
- 2. Select [2 MARKS•CHART].
- 3. Select [0 NEXT] to show the next page of the menu.
- 4. Select [6 CHART DISPLAY].
- 5. Select [ON] to display the chart, or select [OFF] to hide the chart, then left-click.
- 6. Close the menu.

MARKS - CHARTS (2/2)	
1	BACK
2	GRID OFF/ON
3	CHART SETTINGS
4	EMPHASIZE LAND MASS OFF/1/2/3
5	CHANGE CHARTS VECTOR/FISHING/ C-MAP/NAVIONICS
6	CHART DISPLAY OFF/ON

Chart Icons

The chart icon appears at the top-left section of the screen. The icon changes depending on the chart status, as shown below.

Chart Icons	Meaning
	Suitable chart scale.
	Unsuitable chart scale. Press the ZOOM IN or ZOOM OUT key to adjust the chart scale.
	No chart file.

5.11.2 How to align the chart position

When the radar target and the chart are not overlaid correctly, align the chart position.

Note 1: When you activate or deactivate the [MAP ALIGN] function, trails for both own ship and other ships are not reset.

Note 2: Chart alignments are not retained when the radar power is turned off.

1. Right-click the operational display area to show the [CURSOR MENU].
2. Select [MAP ALIGN]. The cursor is now highlighted and the [MAP ALIGN] function is active.
3. Left-click the map at the location you want to move. The map is now "anchored" to the cursor.
4. Move the cursor to align the radar map with the radar screen, then left-click. The indication "MAP ALIGN" appears on the right side of the operational display area.
5. Right-click to deactivate the [MAP ALIGN] function.

Display indications affected by map alignment

The following items are also re-aligned when the [MAP ALIGN] function is activated.

- Map marks
- Drop marks
- Anchor watch settings
- Target tracks
- AIS symbols
- EBL offsets (STAB GND mode only)
- Origin marks
- NAV lines and waypoints
- MOB marks
- Own ship tracks
- Latitude/Longitude Grid
- AIS symbol vector display
- Zoom window display (STAB GND mode only)
- Cursor position coordinates (when CURSOR L/L ALIGN is set to [ON] only)

Display indications unaffected by map alignment

The following items are not re-aligned when the [MAP ALIGN] function is activated.

- Radar echoes
- TT symbol vector display
- PI lines
- Own ship mark
- TT symbols
- EBL/VRM reference point
- OS coordinates ([POSN]) display
- Barge mark

How to disable the map alignment

- 1. Right-click the operational display area to show the [CURSOR MENU].
- 2. Select [MAP ALIGN], then left-click. The cursor is now highlighted and the [MAP ALIGN] function is active.
- 3. Press and hold the **left button**. The "MAP ALIGN" indication is cleared and the map alignment is cleared.
- 4. Right-click to deactivate the [MAP ALIGN] function.

5.11.3 How to select the chart type

You can select one of four types of charts, depending on your requirements.

- 1. Open the menu.
- 2. Select [2 MARKS•CHART].
- 3. Select [0 NEXT] to show the next page of the menu.
- 4. Select [5 CHANGE CHARTS].
- 5. Select either of the following charts, then left-click.
[VECTOR]: Navigational chart (data by FURUNO).
[FISHING]: Fishing chart that shows detailed depth contours.
[C-MAP]: Select this when installing C-MAP chart data.
[NAVIONICS]: Select this when installing Navionics chart data.
- 6. Close the menu.

Note: Depth contours for [FISHING] are drawn differently from navigational chart data (bathymetric chart data). The [FISHING] chart does not have the latest shallow information, so select [VECTOR] when sailing into/out of port or sailing along coastlines.

5.11.4 Chart settings menu

Below is the explanation about the each item of [CHART SETTINGS].

- 1. Open the menu.
- 2. Select [2 MARKS•CHART].
- 3. Select [3 CHART SETTINGS].
The [CHART SETTINGS] menu has four pages.

CHART SETTINGS (1/4)	CHART SETTINGS (2/4)	CHART SETTINGS (3/4)	CHART SETTINGS (4/4)
1 BACK	1 BACK	1 BACK	1 BACK
2 LAND COLOR	2 BUOY	2 ALARM AREA	2 SMALL VESSEL SERVICE
3	OFF/ON	OFF/ON	OFF/ON
3 LAND CONTOUR COLOR	3 DEPTH LINES/CURRENT	3 LIGHT SECTOR	3 MARINE FARM
9	OFF/ON	OFF/ON	OFF/LINE/
4 BACKGROUND COLOR	4 LANDMARKS	4 MOUNTAINTOP	LINE+SYMBOL
1	OFF/ON	OFF/ON	4 OTHER INFO AREAS
5 CHARACTER(IMPORTANT)	5 OBSTACLES	5 LANDSCAPE	OFF/ON
OFF/ON	OFF/ON	OFF/ON	5 SOUNDINGS
6 CHARACTER(OTHER)	6 OBST IN SAFE AREA	6 FOG SIGNAL	OFF/ON
OFF/ON	OFF/ON	OFF/ON	6 ROUTES
7 PLACE NAME	7 FISHING EQUIPMENT	7 SIGNALS	OFF/ON
OFF/ON	OFF/ON	OFF/ON	
8 NAV AIDS	8 COMP	8 SERVICE	
OFF/ON	OFF/ON	OFF/ON	
9 LIGHT BEACON	9 WATER QUALITY	9 HARBOR FACILITIES	
OFF/ON	OFF/ON	OFF/ON	
0 NEXT	0 NEXT	0 NEXT	

Page 1

Page 2

Page 3

Page 4

- 4. Select a menu item to change the settings, then left-click.

5. VIDEO PLOTTER OPERATION

5. Change the settings, then left-click.
6. Close the menu after changing the settings.

A description for each item is listed below.

[LAND COLOR]: Selects color for land from nine available colors.

[LAND CONTOUR COLOR]: Selects color for edge from 15 available colors.

[BACKGROUND COLOR]: Selects color for background from six available colors. Change the background color when targets and chart lines are hard to see.

[CHARACTER(IMPORTANT)]: Turns important text on or off.

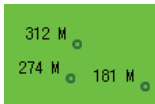
[CHARACTER(OTHER)]: Turns other text on or off.

[PLACE NAME]: Turns geographical name on or off.

[NAV AIDS]: Turns navigational data display on or off for navigational aids ([LIGHT BEACON] on page 1, through to [ROUTES] on page 4). Each navigational aid can be turned on or off individually. To show the data for a navigational aid, the individual setting must also be set to [ON].

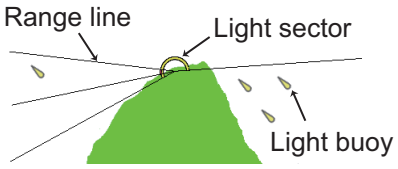
Note: When [NAV AIDS] is set to [OFF], no navigational aid data is displayed, regardless of the individual setting for each navigational aid.

Navigational aid data (see following tables): Turns each mark on or off. To display [MARINE FARM], select [LINE] or [LINE+SYMBOL].

Mark name	Display example	Mark name	Display example	Mark name	Display example
[LIGHT BEACON]		[BUOY]		[DEPTH LINES / CURRENT]	
[LANDMARK S]		[OBSTACLE S]		[OBST IN SAFE AREA]	
[FISHING EQUIPMENT]		[COMP]	Mud	[WATER QUALITY]	
[ALARM AREA]		[MOUNTAIN TOP]		[LANDSCAPE]	
[FOG SIGNAL]		[SIGNALS]		[SERVICE]	
[HARBOR FACILITIES]		[SMALL VESSEL SERVICE]		[MARINE FARM]	
[OTHER INFO AREAS]		[SOUNDING S]		[ROUTES]	

Note: If the text is displayed with a mark, the text is difficult to see depending on the background.

The mark display for light sector differs according to the setting of light beacon. For details, see the table below.

	[LIGHT SECTOR] set to [ON].	[LIGHT SECTOR] set to [OFF].
[LIGHT BEACON] set to [ON].	Light sector and range lines are displayed (lines for range are long). 	Only light sector is displayed (lines for range are short). 
[LIGHT BEACON] set to [OFF].	Light sector and range lines are displayed (range lines are long). 	Light sector is not displayed.

5.11.5 How to show/hide land mass emphasis

[LAND MASS EMPHASIS] sets whether to highlight the outer edge of land masses on the display.

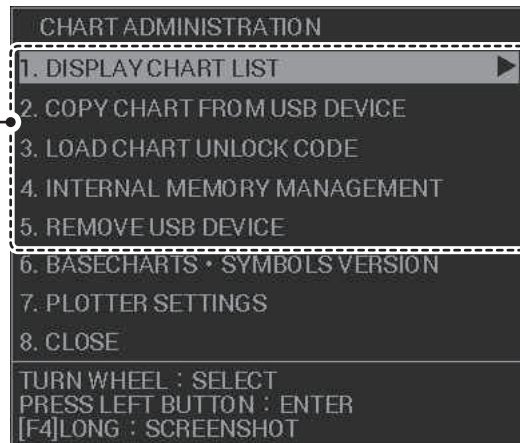
1. Open the menu.
2. Select [2 MARKS•CHART].
3. Select [0 NEXT].
4. Select [4 EMPHASIZE LAND MASS].
5. Select [OFF] to disable the emphasis. There are three levels of emphasis available; a higher setting gives a thicker emphasis line around the land mass.
6. Close the menu.

5.11.6 How to check your charts/symbol versions

You can check the version of your charts and symbols from the [CHART ADMINISTRATION] menu.

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [8 UPDATE CHART]. The confirmation message "OTHER FUNCTIONS WILL STOP DURING THE CHART UPDATE. ARE YOU SURE?" appears.
4. Select [RUN] to access the [CHART ADMINISTRATION] menu.

Instructions for these menu items are contained in the Installation Manual IME-36520



5. Select [6 BASECHARTS • SYMBOLS VERSION]. The version information for your charts and symbols appears.
6. Right-click to go back to the [CHART ADMINISTRATION] menu.
7. Select [7 CLOSE]. The confirmation message [CLOSE CHART ADMINISTRATION AND RESTART THE SYSTEM?] appears.
8. Select [RUN]. The system restarts.

6. MAINTENANCE, TROUBLE-SHOOTING

Periodic checks and maintenance are important for proper operation of any electronic system. This chapter contains maintenance and troubleshooting instructions to be followed to obtain optimum performance and the longest possible life of the equipment. Before attempting any maintenance or troubleshooting procedure please review the safety information below.



WARNING



Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.



Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.

Prevent the potential risk of being struck by the rotating antenna.



A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly to the eyes.

Never look directly into the antenna aperture from a close distance while the radar is in operation, or expose yourself to the transmitting radar at a close distance.



Wear a safety belt and hard hat when working on the antenna unit.

Serious injury or death can result if someone falls from the radar antenna mast.

6

NOTICE

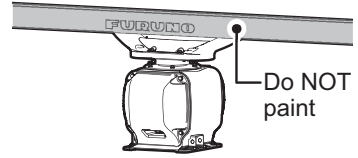
Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.

Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

6.1 Periodic Maintenance Schedule

Regular maintenance is essential to good performance. A regular maintenance program should be established and should at least include the items in the table below.

Interval	Check Point	Checks and measures	Remarks
As required	The LCD will in time accumulate a layer of dust which tends to dim the picture	Check that dust or dirt is not on the display. Wipe it carefully to prevent scratching. For difficult to remove dirt or salt deposits, use a cloth made wet with water and neutral detergent (less than 1% detergent). Squeeze the cloth dry then clean the display. When the display is clean, gently wipe the display with a clean, soft, dry cloth, to prevent scratching.	
	Processor unit cleanliness	Dust and dirt may be removed with a soft cloth.	Do not use chemical-based cleaners to clean the processor unit. They can remove paint and markings.
3 to 6 months	Exposed nuts and bolts on antenna unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace if heavily corroded.	Sealing compound can be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in future.
	Antenna radiator	Check for dirt and cracks on radiator surface. Thick dirt should be wiped off with soft cloth dampened with fresh water. If a crack is found, apply a slight amount of sealing compound or adhesive as a temporary remedy, then call for repair.	Do not use chemical-based cleaners for cleaning. They can remove paint and markings. If you need to remove ice from the antenna unit, use a wooden or plastic head hammer. Cracks on the unit may cause water ingress, causing serious damages to internal circuits.
	Terminal strips and plugs in antenna unit (TECHNICIANS only)	Open antenna cover to check terminal strip and plug connections inside. Also check the rubber gasket of antenna covers for deterioration.	When closing antenna covers in position, be careful not to catch loose wires between covers and unit.
	Adhesive (marine sealant) on nuts and bolts	Check for deteriorations such as splits and peeling. Re-apply as required. For areas with extensive deterioration, remove the existing adhesive before re-applying a fresh coat.	Adhesive deterioration can result in water leakage, which can cause corrosion.
6 months to one year	Terminal strips, sockets, earth terminal on processor unit (TECHNICIANS only)	Check for loose connections. Check contacts and plugs for proper seating, etc.	

Interval	Check Point	Checks and measures	Remarks
Every year	Antenna Unit	Check the antenna unit for corrosion and paint peeling.	If corrosion or paint peeling is found, paint the affected area. Do not paint the antenna (see below), only paint the scanner.  Note: Painting the antenna may result in reduced performance and/or damage to the antenna.
5 years	Grease on antenna rotary (other than FAR-2018/2028-MARK-2/2028-NXT-MARK-2)	Insufficient grease on the antenna rotary may cause cracks in the waterproofing gasket (V-ring). To prevent water leakage due to cracks in the V-ring, use the optional lubrication kit (OP03-229) to apply the grease to the antenna rotary.	Have a qualified technician apply the grease oil to the antenna rotary. If exposed to heavy wind, rain, or waves, it is recommended to apply the grease during the regular maintenance.

6.2 How to Replace the Fuse

Fuses are located as shown in the tables below. Each fuse protects the equipment from reverse polarity of the ship's mains and equipment fault. If a fuse blows, find the cause before replacing it. Use the correct fuse. Using the wrong fuse will damage the equipment and void the warranty.



WARNING

Use the proper fuse.

Use of the wrong fuse can cause fire or electrical shock.

6

Note: For monitor units, see the monitor's operator manual for fuse details.

For all AC-powered configurations

Note: This fuse is located on the front of the processor unit.

Radar Model(s)	Type
FAR-2218(-BB)/FAR-2228(-BB)/FAR-2228-NXT(-BB)/ FAR-2238S(-BB)/FAR-2238S-NXT(-BB)/FAR-2318/ FAR-2328/FAR-2328-NXT/FAR-2328W/FAR-2338SW/ FAR-2338S/FAR-2338S-NXT/FAR-2018-MARK-2/ FAR-2028-MARK-2/FAR-2028-NXT-MARK-2	FGBO-A 250V 7A PBF

For DC-powered configurations

Radar Model(s)	Type
FAR-2218(-BB)/FAR-2228(-BB)/FAR-2228-NXT(-BB)/ FAR-2318/FAR-2328/FAR-2328-NXT/FAR-2018-MARK-2/ FAR-2028-MARK-2/FAR-2028-NXT-MARK-2	FGBO 125V 20A

For configurations with the High Speed Kit installed

Note: This fuse is located on the front of the processor unit.

Radar Model(s)	Type
FAR-2238S(-BB)/FAR-2238S-NXT(-BB)/FAR-2338SW/ FAR-2338S/FAR-2338S-NXT	FGBO-A 250V 3A PBF

For configurations with the Deicer Kit installed

Note: For FAR-2018/2028-MARK-2, this fuse is located inside the deicer unit. For other radars, this fuse is located inside the scanner unit.

Radar Model(s)	Type
FAR-2218(-BB)/FAR-2228(-BB)/FAR-2228-NXT(-BB)/ FAR-2238S(-BB)/FAR-2238S-NXT(-BB)/FAR-2318/ FAR-2328/FAR-2328-NXT/FAR-2328W/FAR-2338SW/ FAR-2338S/FAR-2338S-NXT/FAR-2018-MARK-2/ FAR-2028-MARK-2/FAR-2028-NXT-MARK-2	FGBO-A 250V 3A PBF

6.3 Life Expectancy of Major Parts

This radar has consumable parts, and the table that follows shows the estimated life expectancy for the consumable parts. Request a FURUNO agent or dealer to replace the consumable parts, to get the best performance and longest possible life from the equipment.

Note: The expected lifetimes are typical values. Actual lifetime depends on usage and ambient temperature.

Part	Type	Life expectancy	Remarks	
Antenna Unit				
Magnetron* ¹	FNE1201	5,000 hours	For X-Band radar (12kW)	Check number of hours used at TX time.
	MG5436	5,000 hours	For X-Band radar (25kW)	
	MG5223F	7,000 hours	For S-Band radar (30kW)	
Motor* ²	BV2-K155	-	For S-Band radar	
	BV2-K156	-	For X-Band radar	
Monitor Unit				
Bezel & LCD assembly	Refer to the Operator's Manual for the Monitor Unit.			

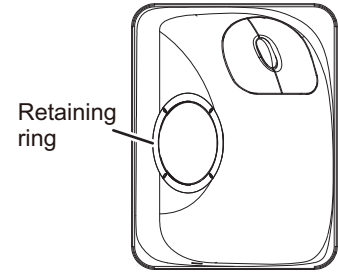
^{*1}: The magnetron is a consumable item. The effectiveness of your magnetron will decrease over time, causing lower-than-normal signal strength and loss of echoes. Magnetrons should be changed regularly. The table above shows the typical life-span of a magnetron used under normal conditions.

^{*2}: Lifetime of the motor varies greatly depending on usage environment. Regularly request the maintenance by a service technician. Even if there is no trouble or error, it is recommended to replace the motor every five years.

6.4 Trackball Maintenance

If the cursor skips or moves abnormally, clean the trackball using the procedure below.

1. Turn the retaining ring counterclockwise 45° to unlock it.
2. Remove the retaining ring and ball.
3. Clean the ball with a soft, lint-free cloth, then blow carefully into the ball-cage to dislodge dust and lint.
4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.
5. Make sure that fluff from the swab is not left on the rollers.
6. Replace the ball and retaining ring. Be sure the retaining ring is not inserted reversely.



6.5 Easy Troubleshooting

This section provides troubleshooting procedures that the user can follow to restore normal operation. If you cannot restore normal operation, do not attempt to check inside any unit. Any repair work is best left to a qualified technician.

Problem	Possible cause	Remedy
Key beep inaudible.	Key beep turned off.	Adjust key beep level in the [OPERATION] menu, referring to section 1.10.
Picture not updated or picture freeze. 30 seconds after the picture freezes, the buzzer sounds, the ALARM ACK key blinks and alarm signal is output.	Video freeze.	Turn the power off and on again to restore normal operation.
Power is ON but nothing appears on monitor.	Brilliance is too low.	Adjust the brilliance, referring to section 1.3.
Marks, indications and noise appear but no echo.	Tx high voltage protection circuit has activated.	Reset the power to restore normal operation.
Range changed but radar picture does not change.	Defective range key or video freeze up.	Adjust the range with the control unit, or the [RANGE] box several times. If that does not work try to turn the power off and on again to see if the problem might be video freeze up. If unsuccessful, replacement of keypad may be required.
Only two PI lines when six lines are wanted	Incorrect setting of PI line interval	Adjust PI line interval, referring to section 1.40.3. Also, the setting for number of PI lines to display may be inappropriate. Check the menu setting for number of PI lines, referring to section 1.40.2.

Problem	Possible cause	Remedy
Range rings are not displayed	Range rings are turned off	Try turning on the range rings with [RANGE RING] in the [NAVTOOL] menu. If they do not appear, their brilliance may be too low. Adjust their brilliance in the [BRILL] menu.
Tracked target not tracked correctly	Poor definition of targets in sea clutter	Adjust A/C SEA and A/C RAIN referring to section 1.20 and section 1.21.
Tuning adjusted but poor sensitivity	Second trace echo rejector on or dirt on radiator face	• Disable the second trace echo rejector, referring to section 1.29. • Clean the radiator face.

6.6 Advanced-level Troubleshooting

This section describes how to cure hardware and software troubles that should be carried out by qualified service personnel.

Note 1: This radar equipment contains complex modules in which fault diagnosis and repair down to component level are not practicable by users.

Note 2: When replacement of the MAIN board is necessary, the previous settings can be transferred to new MAIN board as follows:

- Save your settings to a SD-card, referring to section section 1.55.
- After replacing the MAIN board, load the entire contents of the SD-card to the radar, referring to section section 1.55 for the procedure.

Problem	Possible cause	Remedy
Cannot turn power on.	1) Blown fuse. 2) Mains voltage/polarity. 3) Power supply board (PWR1 and/or PWR2) inside the Processor unit.	1) Replace blown fuse. 2) Correct wiring and input voltage. 3) Replace the faulty power supply board.
Brilliance adjusted but no picture.	MAIN board - inside the Processor unit.	Replace MAIN board.
Antenna not rotating.	1) Antenna drive mechanism 2) MTR-DRV board	1) Replace antenna drive mechanism. 2) Replace the MTR-DRV board.
Data and marks not displayed in Transmit status	MAIN board - inside the Processor unit.	Replace MAIN board.
Adjust GAIN with A/C SEA set at minimum. Marks and indications appear but no noise or echo.	1) IF amplifier 2) Signal cable between antenna and processor unit	1) Replace IF amplifier. 2) Check continuity and isolation of coaxial cable. Note: Disconnect the plug and lugs at both ends of coaxial cable before checking it by ohmmeter.

Problem	Possible cause	Remedy
Marks, indications and noise appear but no echo (transmission leak representing own ship position is absent)	1) TX high voltage protection circuit has activated. 2) Magnetron 3) MD board inside the antenna. 4) SPU board inside the antenna.	1) Reset power to restore normal operation. 2) Check magnetron current. Replace magnetron. 3) Replace MD board. 4) Replace SPU board.
Picture not updated or picture freeze-up	1) Rotary Encoder inside the antenna unit. 2) SPU board inside the antenna. 3) Video freeze-up	1) Check the connection of signal cables. 2) Replace SPU board. 3) Turn the radar off, then on.
Incorrect orientation of picture	1) Rotary Encoder inside the antenna unit 2) SPU board inside the antenna unit. 3) MTR-DRV board inside the antenna unit.	If the message "LOST HEADLINE" appears in orange letters inside the alert box, the heading signal is lost or interrupted. Check the heading line signal cable and board connections. If there is no problem with cables or connections, replace the faulty board.
Cannot operate radar from on-screen boxes	MAIN board - inside the Processor unit.	Replace MAIN board.
Radar is properly tuned but poor sensitivity	1) Deteriorated magnetron 2) Detuned MIC 3) Dirt on radiator face 4) Water ingress to the waveguide or other feeder line 5) Second trace echo rejection is ON	1) With the radar transmitting on 48 nm range, check magnetron current. If current is below normal, magnetron may be defective. Replace it. 2) Check MIC detecting current. If it is below normal value, MIC may have become detuned. MIC must be tuned. 3) Clean the radiator surface. 4) Remove water from the feeder line. 5) Disable the second-trace echo rejector referring to section 1.29.
Range changed but radar picture not changing	1) Defective range key 2) SPU board inside the antenna. 3) Video freeze up	1) Adjust the range with the control unit, or the [RANGE] box several times. If unsuccessful, replacement of keypad may be required. 2) Replace SPU board. 3) Turn off and on radar.
Interference rejector is inoperative (interference rejection level not displayed)	SPU board inside the antenna.	Replace SPU board.
Echo stretch is ineffective (neither ES1, ES2 nor ES3 is displayed)	SPU board inside the antenna.	Replace SPU board.
Range rings are not displayed	1) Adjust the brilliance of range rings on the BRILL menu to see if intensity is increased 2) MAIN board	1) Replace associated circuit board if unsuccessful. 2) Replace MAIN board.

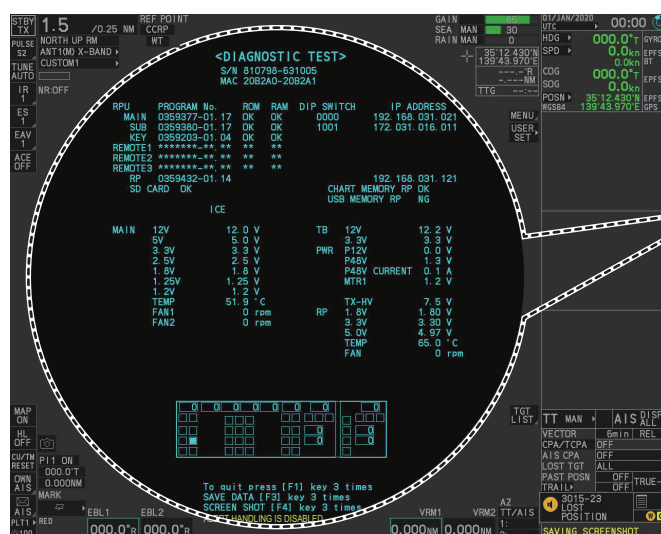
Problem	Possible cause	Remedy
Poor discrimination in range	Sea clutter control not functioning properly	Improper setting of A/C SEA. If A/C SEA is seen only at very close range, suspect inaccurate frequency of reference oscillator.
True motion orientation not working correctly	1) Incorrect menu setting 2) Speed entry incorrect 3) TM display inaccurate	1) Referring to section 1.30, select TM orientation mode. 2) Enter correct own ship speed referring to section 1.12. 3) Make sure that speed and compass inputs are accurate.
Target not tracked correctly	Poor definition of targets in sea clutter	Adjust A/C SEA and A/C RAIN referring to section 1.20 and section 1.21.
Buttons on trackball module operated but no response	Trackball module	Replace trackball module.
Picture is not updated with each sweep.	Motor/gears	Check the motor and gears. Replace if worn.

6.7 Diagnostics

A diagnostic test program is provided to test major circuit boards in the control unit, processor unit and card I/F unit. During the test, alerts cannot be acknowledged and the buzzer does not sound. Further, the normal radar picture is not visible. Take extra caution regarding your surroundings when conducting the test.

Proceed as follows to execute the diagnostic test:

1. Open the [MAIN MENU].
 2. Select [9 INITIAL SETTINGS].
 3. Select [7 TESTS].
 4. Select [2 DIAGNOSTIC TEST]. The system begins a diagnostic test.
- The Processor Unit is tested first and the test results appear after a few moments.

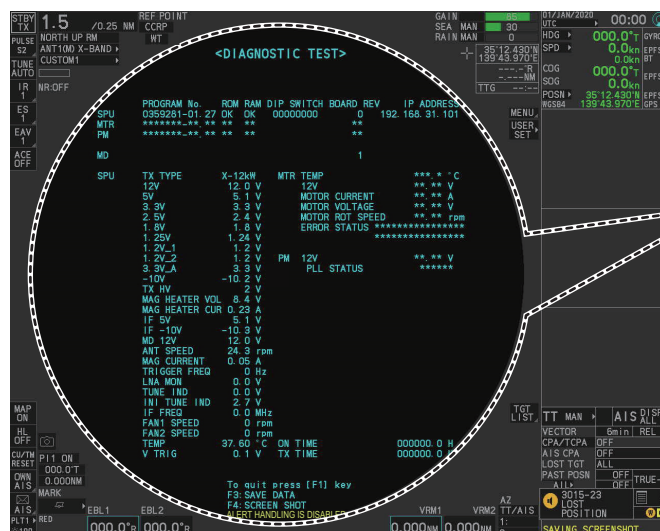


Processor Unit and Control Unit diagnostic test results appear here.

You can save a screenshot to an SD Card if there is an SD Card inserted into the Processor Unit. Press the **F4** key three times to save a screenshot.

A keyboard test is available at the bottom of the test results, also. Press each key on the control unit to highlight the corresponding area on-screen. Press the same key again to remove the highlight.

5. Press the **F1** key three times to show the results for antenna test.



Antenna diagnostic test results appear here.

You can save a screenshot to an SD Card if there is an SD Card inserted into the Processor Unit. Press the **F4** key three times to save a screenshot.

6. Press the **F1** key to close the test results and complete the test.

Diagnostic test results

The following table lists each test result along with the normal value range for each item. "OK" appears for normal operation. If "NG" (No Good) appears, corresponding components may be defective.

Also, if a connected fan or PCB shows the check results as asterisks, it is an indication that the fan or PCB has failed, or is disconnected.

If there are any components which are suspected to be defective, or any test does not complete satisfactorily, consult your dealer for advice.

Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
MAIN (Processor Unit) test			
[PROGRAM No.]		Shows the program version number.	
[ROM]		OK	
[RAM]		OK	
[DIP SWITCH]		Shows the DIP SWITCH settings.	
[IP ADDRESS]		Shows the IP address for the Processor Unit.	
[SD CARD]		OK	
[SD CARD RP]		(Not currently used)	
[HSC]		Shown only for systems with the optional High Speed Conversion kit.	
[RMS]		Shown only when Remote Maintenance Service is enabled.	
[ICE]		Shown only when Ice Mode is enabled.	
[MAIN]	[12V]	10.8 to 13.2 V	
	[5V]	4.7 to 5.3 V	
	[3.3V]	3.0 to 3.6 V	
	[2.5V]	2.3 to 2.7 V	
	[1.8V]	1.6 to 2.0 V	
	[1.25V]	1.13 to 1.38 V	

6. MAINTENANCE, TROUBLESHOOTING

Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
[MAIN]	[1.2V]	1.0 to 1.3 V	
	[TEMP]	Ambient temperature +30°C or less	
	[FAN1]	3700 to 5700 rpm	
	[FAN2]	3700 to 5700 rpm	
	[FAN3]	• X/S-Band radars with 24 rpm config: Not shown • S-Band radars with 42 rpm (HSC) config: 3700 to 5700 rpm	
[TB]	[12V]	10.8 to 13.2 V	
	[3.3V]	3.0 to 3.6 V	
[PWR]	[P12V]	10.8 to 13.2 V	
	[P48V]	46 to 50 V	
	[P48 V CURRENT]	0 to 3 A	
	[MTR1]	45.1 to 51.3 V	
	[MTR2]	• X/S-Band radars with 24 rpm config: Not shown • S-Band radars with 42 rpm (HSC) config: 45.1 to 51.3 V	
	[TX HV]	500 to 570 V	
RP Board (For A/B/W-types with Radar Plotter functionality only)			
[PROGRAM No.]		Shows the program version number.	
[IP ADDRESS]		Shows the IP address of the RP board.	
[CHART MEMORY RP]		OK	
[USB MEMORY RP]		OK	
RP	[1.8V]	1.6 to 2.0 V	
	[3.3V]	3.0 to 3.6 V	
	[5.0V]	4.7 to 5.3 V	
	[TEMP]	Ambient temperature +30°C or less	
	[FAN]	3700 to 5700 rpm	
SPU (Antenna)			
[PROGRAM No.]		Shows the program version number.	
[ROM]		OK	
[RAM]		OK	
[DIP SWITCH]		Shows the DIP SWITCH settings. (For FAR-2018/2028-MARK-2, "00000000" is shown)	
[BOARD REV]		Shows the revision number for each PCB.	
[IP ADDRESS]		Shows the IP address for the SPU board.	
[SPU] (other than FAR-2018/2028-MARK-2/2028-NXT-MARK-2)	[TX TYPE]	X-12kW/X-25kW/S-30kW	S-Solid/X-Solid
	[12V]	11.4 to 12.6 V	
	[5V]	4.75 to 5.25 V	
	[3.3V]	3.18 to 3.42 V	
	[2.5V]	2.4 to 2.6 V	
	[1.8V]	1.71 to 1.89 V	
	[1.25V]	1.19 to 1.31 V	
	[1.2V_1]	1.14 to 1.26 V	
	[1.2V_2]	1.14 to 1.26 V	
	[3.3V_A]	3.18 to 3.42 V	
	[-10V]	-10.5 to -9.5 V	"not connect"
	[TX HV]	500 to 560 V	"not connect"

Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
[SPU] (other than FAR-2018/2028-MARK-2/2028-NXT-MARK-2)	[MAG HEATER VOL]	• X-Band, 12 kW: 8.1 to 8.6 V or 6.8 to 7.3 V • X-Band, 24 kW: 7.0 to 7.5 V or 5.7 to 6.2 V • S-Band: 7.4 to 7.9 V or 6.3 to 6.8 V	"not connect"
	[MAG HEATER CUR]	• X-Band: 0.5 to 0.6 A • S-Band: 1.1 to 1.4 A	"not connect"
	[IF 5V]	4.75 to 5.25 V	"not connect"
	[IF -10V]	-10.5 to -9.5 V	"not connect"
	[MD 12V]	11.4 to 12.6 V	"not connect"
	[ANT SPEED]	• 24 rpm antennas: 22 to 26 rpm • 42 rpm antennas: 40 to 44 rpm	
	[MAG CURRENT]	• X-Band: 5.0 to 12.0 A* • S-Band: 6.0 to 10.0 A* *: Value when the pulse length is set to [L].	"not connect"
	[TRIGGER FREQ]	• STBY: 0 Hz • [2ND ECHO REJ]=[OFF], TT range*= 24NM: S1: 2640 to 3360 Hz, S2: 2640 to 3360 Hz, M1: 1320 to 1680 Hz, M2: 1060 to 1340 Hz, M3: 880 to 1120 Hz, L: 530 to 670 Hz • [2ND ECHO REJ]=[OFF], TT range*= 32NM: S1: 1940 to 2460 Hz, S2: 1940 to 2460 Hz, M1: 1320 to 1680 Hz, M2: 1060 to 1340 Hz, M3: 880 to 1120 Hz, L: 530-670 • [2ND ECHO REJ]=[ON]: S1: 2640 to 3360 Hz, S2: 2640 to 3360 Hz, M1: 440 to 560 Hz, M2: 440 to 560, M3: 440 to 560 Hz, L: 440 to 560 Hz *: Maximum TT range is set at installation.	
	[LNA MON]	0.5 to 1.5 V	not connect
	[TUNE IND]	2.0 to 3.0 V	not connect
	[INI TUNE IND]	2.0 to 3.0 V	not connect
	[IF FREQ]	• Pulse length = [S1], [S2]: 0.0 MHz • Pulse length = other than the above settings: 55.0 to 65.0 MHz	not connect
	[FAN1 SPEED]	• X-Band: 3000 to 5000 rpm • S-Band: 0 rpm	• X-Band: 3000 to 5000 rpm • S-Band: Not shown
	[FAN2 SPEED]	3000 to 5000 rpm	
	[TEMP]	Ambient temperature +30°C or less	
	[V TRIG]	10.0 to 18.0 V	not connect
[ON TIME]	Shows the total operating time.		
[TX TIME]	Shows the total transmission time.		

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Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
[SPU] (FAR-2018/ 2028- MARK-2)	[TX TYPE]	X-12kW/X-25kW	-
	[12V]	11.4 to 12.6 V	-
	[5V]	4.75 to 5.25 V	-
	[2.5V]	2.4 to 2.6 V	-
	[1.8V]	1.71 to 1.89 V	-
	[1.8V_A]	1.71 to 1.89 V	-
	[-5V]	-5.5 to -4.65 V	-
	[TX HV]	500 to 560 V	-
	[ANT SPEED]	• 24 rpm antennas: 22 to 26 rpm • 42 rpm antennas: 40 to 45 rpm	-
	[MAG CURRENT]	5.0 to 12.0 A* *: Value when the pulse length is set to [L].	-
	[TRIGGER FREQ]	• STBY: 0 Hz • [2ND ECHO REJ]=[OFF], TT range*= 24NM: S1: 2640 to 3360 Hz, S2: 2640 to 3360 Hz, M1: 1320 to 1680 Hz, M2: 1060 to 1340 Hz, M3: 880 to 1120 Hz, L: 530 to 670 Hz • [2ND ECHO REJ]=[OFF], TT range*= 32NM: S1: 1940 to 2460 Hz, S2: 1940 to 2460 Hz, M1: 1320 to 1680 Hz, M2: 1060 to 1340 Hz, M3: 880 to 1120 Hz, L: 530 to 670 Hz • [2ND ECHO REJ]=[ON]: S1: 2640 to 3360 Hz, S2: 2640 to 3360 Hz, M1: 440 to 560 Hz, M2: 440 to 560 Hz, M3: 440 to 560 Hz, L: 440 to 560 Hz *: Maximum TT range is set at installation.	
	[LNA MON]	0.5 to 1.5 V	-
	[TUNE IND]	1.8 to 3.3 V	-
	[INI TUNE IND]	1.8 to 3.3 V	-
	[IF FREQ]	• Pulse length = [S1], [S2]: 0.0 MHz • Pulse length = other than the above settings: 55.0 to 65.0 MHz	-
	[FAN1 SPEED]	not connect	-
	[FAN2 SPEED]	3000 to 5000 rpm	-
	[TEMP]	Ambient temperature +30°C or less	-
	[V TRIG]	10.0 to 18.0 V	-
	[ON TIME]	Shows the total operating time.	
	[TX TIME]	Shows the total transmission time.	
[SPU] (FAR-2028- NXT- MARK-2)	[TX TYPE]	-	X-Solid
	[12V]	-	10.8 to 13.4 V
	[5V]	-	4.5 to 5.6 V
	[3.3V]	-	3.0 to 3.6 V
	[1.8V]	-	1.6 to 2.0 V
	[1.2V_1]	-	1.1 to 1.3 V
	[3.3V_A]	-	2.9 to 3.7 V
	[1.8V_A]	-	1.6 to 2.0 V
	[1.2V_A]	-	1.1 to 1.3 V
	[1.5V]	-	1.3 to 1.7 V

Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
[SPU] (FAR-2028-NXT-MARK-2)	[0.9V_1]	-	0.8 to 1.0 V
	[-5V]	-	-6.4 to -4.4 V
	[ANT SPEED]	-	• 24 rpm antennas: 22 to 26 rpm • 42 rpm antennas: 40 to 45 rpm
	[FAN1 SPEED]	-	1900 to 4600 rpm
	[FAN2 SPEED]	-	1900 to 4600 rpm
	[TEMP]	-	Ambient temperature +30°C or less
	[ON TIME]	Shows the total operating time.	
	[TX TIME]	Shows the total transmission time.	
[MTR] (other than FAR-2018/2028-MARK-2/2028-NXT-MARK-2)	[TEMP]	Ambient temperature +30°C or less	
	[12V]	9 to 15 V	
	[MOTOR CURRENT]	• X-Band, 24 rpm: 0.8 A • X-Band, 42 rpm: 1.2 A • S-Band, 24 rpm: 1.3 A • S-Band, 42 rpm: 2 A	• 24 rpm: 1.3 A • 42 rpm: 2 A
	[MOTOR VOLTAGE]	43 to 53 V (33 to 53 V for antenna units installed on the foremast.)	
	[MOTOR ROT SPEED]	0 (STBY)/24/36/42	
	[ERROR STATUS]	Blank indicates no errors. When an error is found, the relevant error code appears.	
[MTR] (FAR-2018/2028-MARK-2/2028-NXT-MARK-2)	[TEMP]	Ambient temperature +30°C or less	
	[12V]	9 to 15 V	9 to 15 V
	[MOTOR CURRENT]	• 24 rpm: 0.8 A • 42 rpm: 1.2 A	
	[MOTOR VOLTAGE]	43 to 53 V (33 to 53 V for antenna units installed on the foremast.)	43 to 53 V
	[MOTOR ROT SPEED]	0 (STBY)/24/36/43	
	[ERROR STATUS]	Blank indicates no errors. When an error is found, the relevant error code appears.	
	[MAG HEATER VOL]	• 12 kW, STBY/S1/S2: 7.85 to 8.75 V • 12 kW, M1/M2/M3/L: 6.55 to 7.45 V • 25 kW, STBY/S1/S2: 6.75 to 7.65 V • 25 kW, M1/M2/M3/L: 5.45 to 6.35 V	5.5 to 6.5 V
	[MAG HEATER CUR]	0.485 to 0.655 A	• STBY: 0 to 0.2 A • TX: 0.5 to 1.0 A
	[50V]	49 to 50.4 V	-

Tested item		Normal value or Description	
		Magnetron Radar	Solid State Radar
[PM]	[12V]	9 to 15 V	
	[PLL STATUS]	For X-Band (with board revision number 1 or earlier) and S-Band (with board revision number 0): UNLOCK For X-Band (with board revision number 2 or later) and S-Band (with board revision number 1 or later): • PM activated: LOCK • PM inactive: UNLOCK	• PM activated: LOCK • PM inactive: UNLOCK
[RF-CONV] (FAR-2028-NXT-MARK-2)	TEMP	Ambient temperature +30°C or less	
	[6V]	-	5.5 to 6.5 V
	[48V]	-	48 to 52 V
	[IF PLL STATUS]	-	LOCK
	[RF PLL STATUS]	-	LOCK
	[HPA BROKEN DEVICE]	-	0

6.8 Sentence Monitor

You can check which sentences input to the radar.

1. Open the [MAIN MENU].
2. Select [9 INITIAL SETTINGS].
3. Select [7 TESTS].
4. Select [3 SENTENCE MONITOR].
5. Select the item you want to check.
All sentences input to the radar for the selected item appear on the screen. Press the **F3** key to save the sentence information to the SD Card.

SENTENCE MONITOR	
1	BACK
2	HDG
3	GPS
4	LOG
5	AIS
6	AMS
7	ECDIS
8	LAN1
9	LAN2

Press the **F4** key to save an screenshot to the SD Card.

Note: If an SD Card is not connected to the Processor Unit, you cannot save sentence information or screenshots.

6. Press the **F1** key to close the sentence information.
7. Repeat steps 5 and 6 to view other sentence information as required.
8. Close the menu.

6.9 Fallback Arrangements

If the top priority sensor (for example EPFS1) cannot be used, this equipment automatically uses the second priority sensor (for example, EPFS2) when multiple sensors (EPFS1 and EPFS2 for example) are installed. When there is no fallback sensor available, each function is limited as follows:

Sensor	Function limitations
Heading sensor	- The [HDG] indication reads "****. *°". - The orientation mode is automatically set to [HEAD-UP]. - TT, AIS, radar map and echo averaging are disabled.
Speed sensor	When [LOG(WT)] is selected: - The sensor used is automatically switched in the following priority order: EPFS(BT) → LOG(BT). - The SPD indication reads "****. * kn" when both EPFS(BT) and LOG(BT) cannot be used.
	When [LOG(BT)] is selected: - The sensor used is automatically switched in the following priority order: EPFS(BT) → LOG(WT). - The SPD indication reads "****. * kn" when both EPFS(BT) and LOG(WT) cannot be used.
	When [EPFS(BT)] is selected: - The sensor used is automatically switched in the following priority order: LOG(BT) → LOG(WT). - The SPD indication reads "****. * kn" when both LOG(BT) and LOG(WT) cannot be used.
COG/SOG sensor	- When the EPFS sensor cannot be used, the values of COG and SOG are calculated from HDG and LOG(BT). - Additionally when the heading sensor cannot be used, the values of SOG is calculated from LOG(BT). The COG indication reads "****. *°".
Position sensor	- The POSN indication reads all asterisks. - AIS and radar map are disabled.

6.10 Administrator Menu

There are two types of login authorities: user (navigator) and administrator (service technician). The menus that can be operated differ depending on the login authority. The administrator can access and change all menus. However, the user cannot access and change the network and security settings.

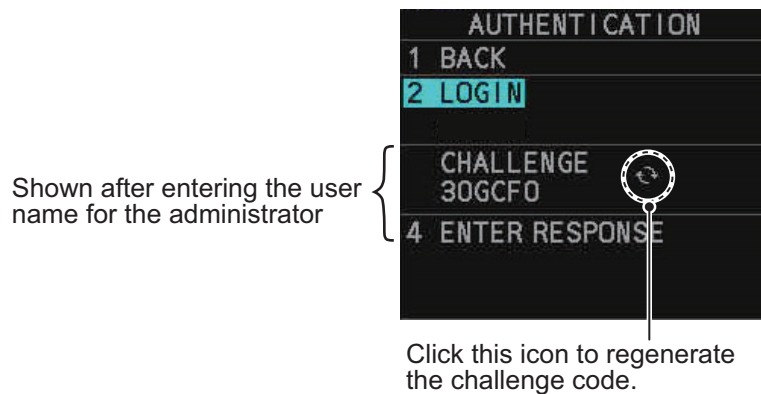
6.10.1 How to log in as an administrator

When this equipment is started up, it automatically logs in as a user. To log in as an administrator, do as follows.

1. Open the menu.
2. Select [9 INITIAL SETTING].
3. Select [9 AUTHENTICATION].
4. Select [2 LOGIN].
The software keyboard appears.

6. MAINTENANCE, TROUBLESHOOTING

- Using the software keyboard, input the user name for the administrator, then select [END].



- Select [4 ENTER RESPONSE].
The software keyboard appears.
- Generate a one-time password (response code) from the challenge code on the screen and enter the password using the software keyboard, then select [END].
- Close the menu.

Note: If there is no operation for ten minutes after logging in as an administrator or if the power is turned off, you will be automatically logged out. The timeout time can be changed. For details, ask your dealer.

6.10.2 How to log out from the administrator menu

To log out from the administrator menu, do as follows.

- Open the menu.
- Select [9 INITIAL SETTING].
- Select [9 AUTHENTICATION].
- Select [5 LOGOUT].
- Select [YES] to log out from the administrator menu.
- Close the menu.

6.11 Network Security Setting

When a network communication overload is detected on the LAN1 or LAN2 port, the DoS attack detection alert is generated. If the network load increases after the alert is generated, this equipment automatically shuts down the network communication. To manually shut down the network communication, do as follows.

- Open the menu.
- Select [9 INITIAL SETTING].
- Select [0 NEXT] to show the next menu page.

4. Select [2 SECURITY].
5. Select [4 LOCKDOWN].
6. Select [2 LAN1] or [3 LAN2].
7. Select [ON] to shut down the network communication from the selected LAN port. Select [OFF] to deactivate the network shutdown.



Note 1: The network shutdown is not automatically deactivated. Deactivate it from the [LOCKDOWN] menu or reboot the system.

Note 2: When the LAN1 port is shut down, the interswitch function cannot be used. When the LAN2 port is shut down, this equipment cannot receive the IEC61162-450 sentences. If the VDR or CAM equipments are connected to the LAN2 port, these equipments cannot receive the radar image or alert signals from this equipment.

8. Close the menu.

6.12 Remedy for Cyber Incidents

If a network communication overload (risk of a DoS attack) is detected on the LAN1 or LAN2 port, the “NETWORK OVERLOAD” alert occurs. When this alert occurs, do the following actions.

Note: If the network load increases after the alert is generated, this equipment automatically shuts down the network communication on the LAN port.

Actions for the operator

To isolate network(s), shut down the network communication on the LAN1 or LAN2 port referring to the section 6.11, or turn the system off. After rectifying the incident, deactivate the network shutdown.

In preparation for cyber incidents, back up the install and setting data regularly.

- Backup frequency: At least once a week.
- Backup location: Store the media (SD card) that contains the backup data in a secure location and disconnect the media from the network.

Ask your dealer to restore the system after a cyber incident.

6.13 Checking the Operation of Security Functions

To check that the security functions are working properly, do as follows.

Actions for the operator

- Perform the diagnostic test referring to section 6.7 to check that the software version is the latest. For the latest software version, ask your dealer.

Actions for the service technician

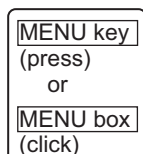
- Open the sentence monitor window referring to the section 6.8 to check that the equipment is receiving sentences from the port specified in the [INPUT PORT SETTINGS] menu.
- Check that the settings for the security data are compatible with the security policy of the ship's owner.
- Try to login with the wrong password. Confirm that the "AUTH FAILED" error occurs and that the error is recorded in the log file.

The security data are listed as follows:

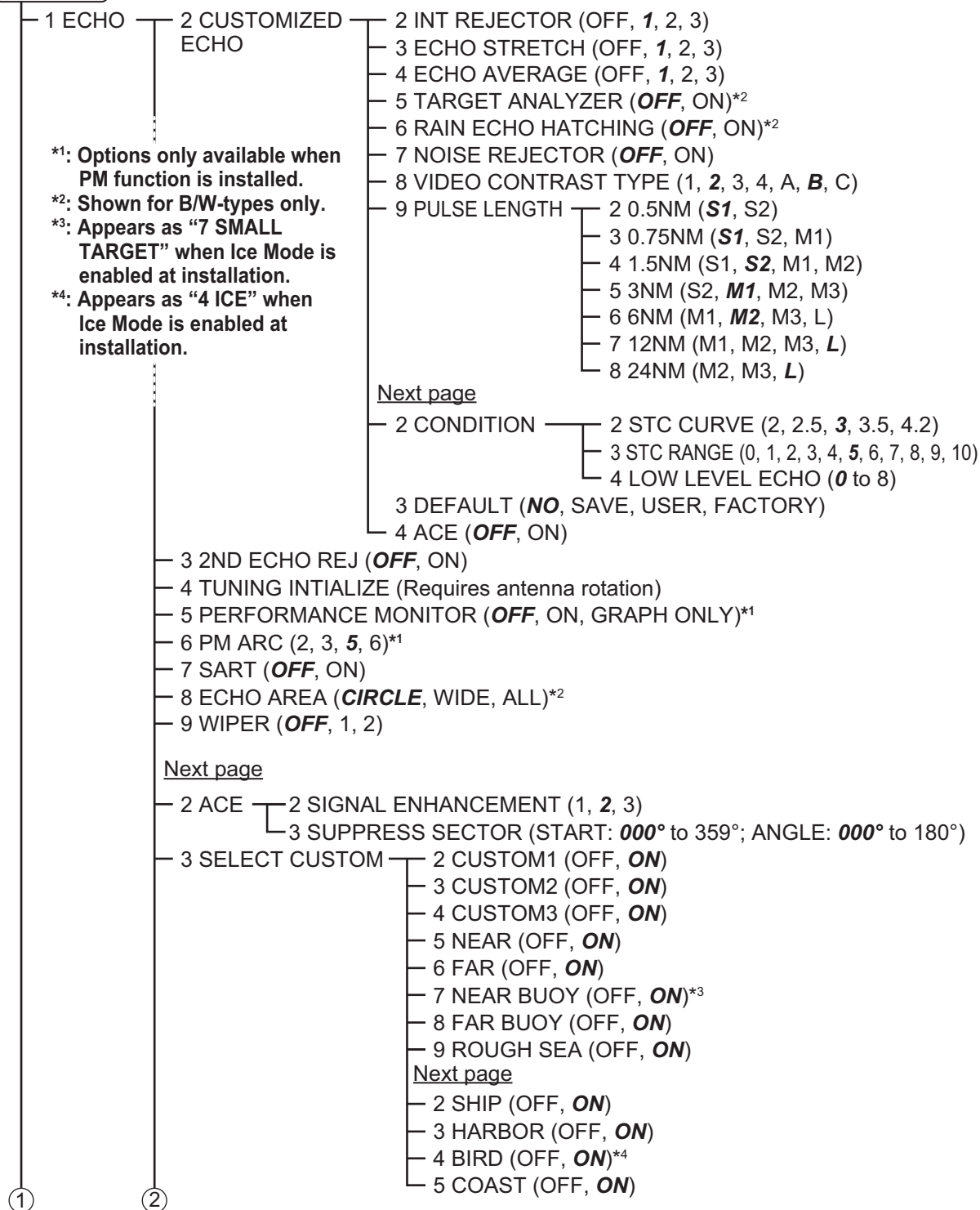
- | | |
|--|--|
| • THD connection settings | • SDME connection settings |
| • EPFS connection settings | • AIS connection settings |
| • VDR connection settings | • CAM connection settings |
| • BNWAS connection settings | • Anemometer connection settings |
| • Water current sensor connection settings | • Water temperature sensor connection settings |
| • Echo sounder connection settings | • HermAce connection settings |
| • GSU connection settings | • ECDIS connection settings |
| • Monitor connection settings | • Radar number |
| • LAN1 network settings | • LAN2 network settings |
| • LAN3 network settings | • Transmission group settings |
| • Selection of receiving group | • Serial number |
| • Reference time | • Import policy for unsigned files |
| • Certificate trust anchor settings | • Audit log retention period settings |
| • Lockout (audit policy) | • SD card insertion/removal (audit policy) |
| • Autorun detection (audit policy) | • Dip switch (audit policy) |
| • Alert sound (audit policy) | • CPA/TCPA function (audit policy) |
| • TT/AIS function (audit policy) | • Granting recovery point creation privilege |
| • Indication output setting | • Session timeout setting |
| • Pointing device connection settings | |

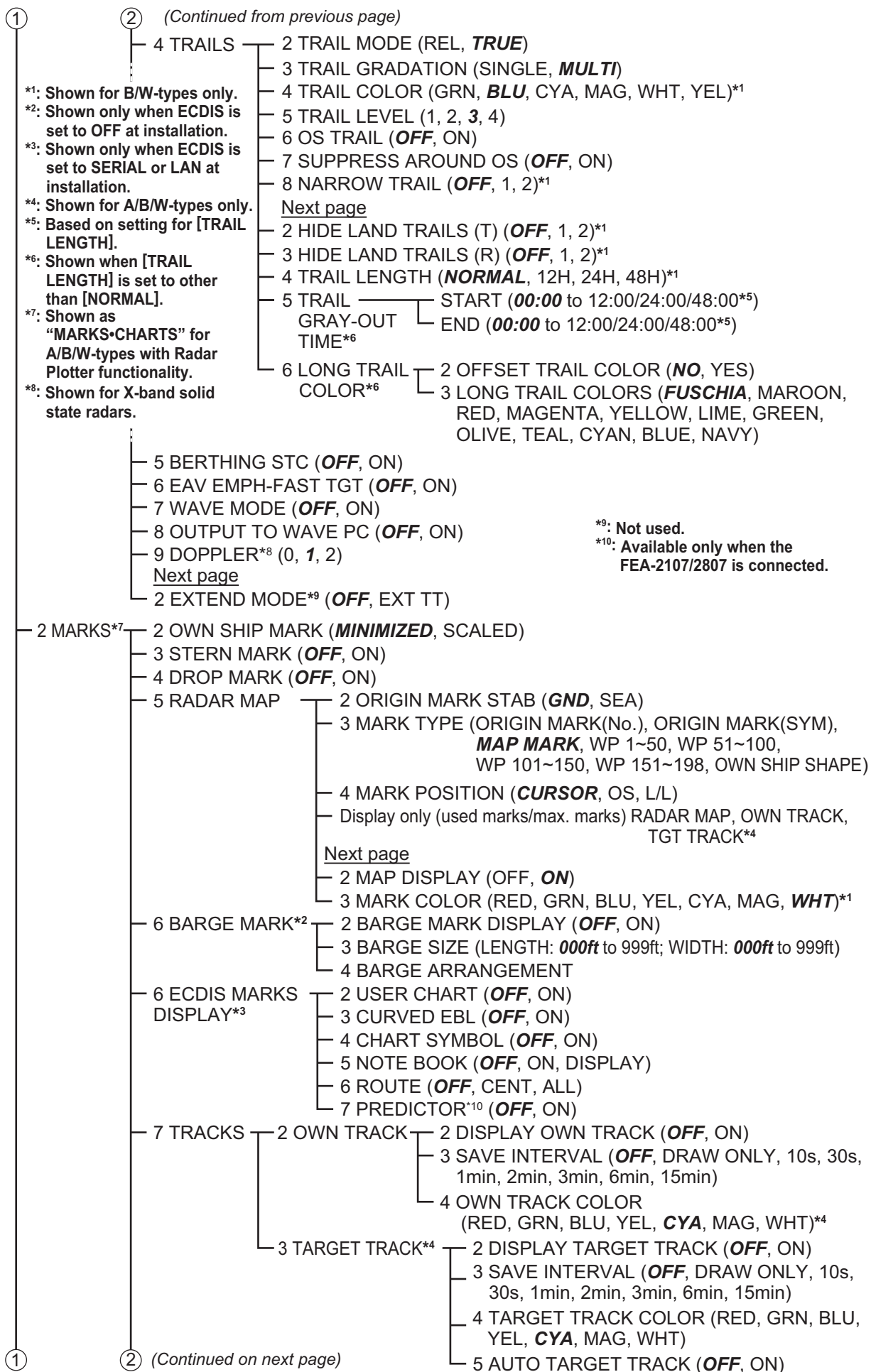
After checking the above items, save the install data and setting data as necessary, referring to the section 1.55.6.

APPX. 1 MENU TREE

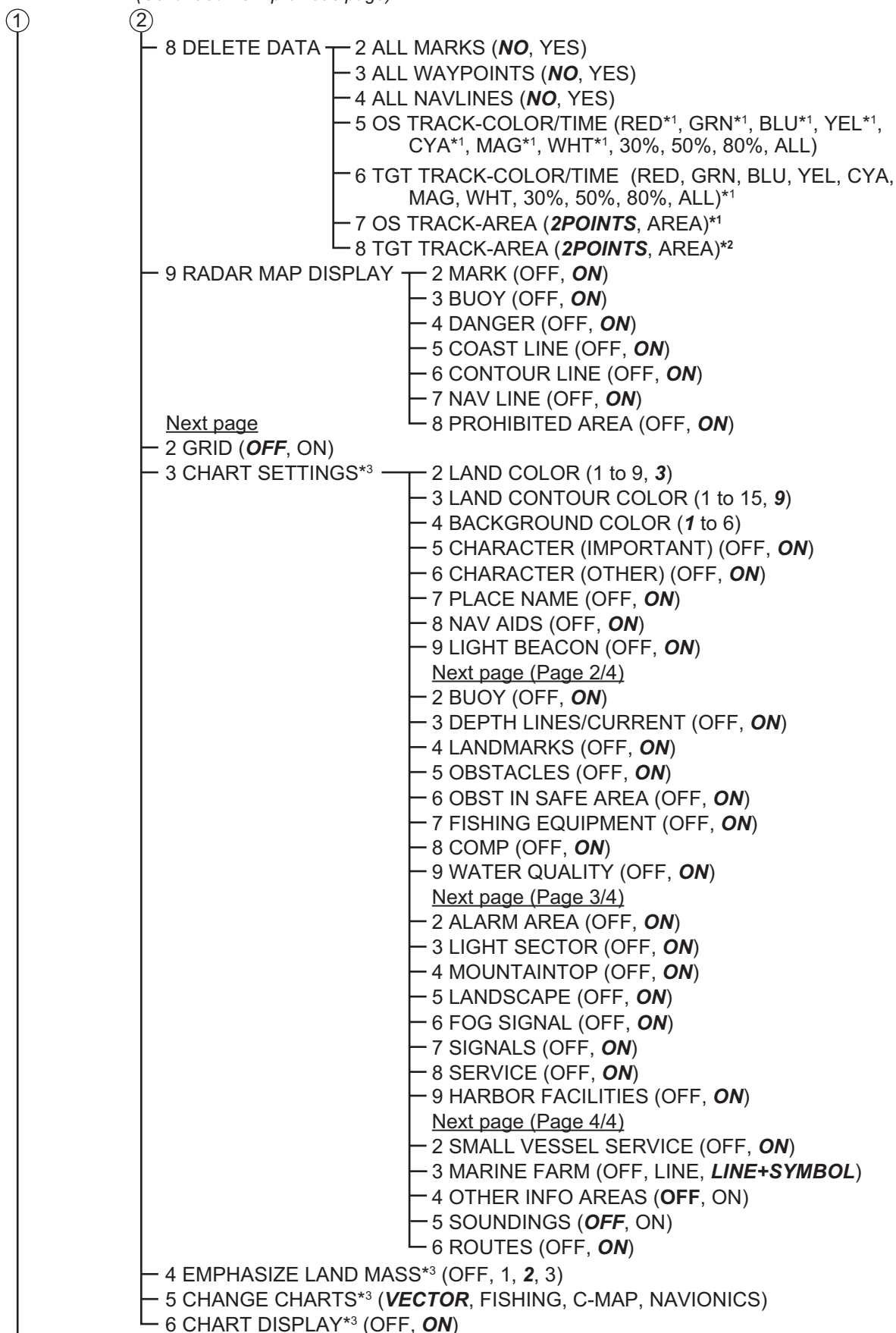


Default settings are listed in ***Bold Italic*** font.



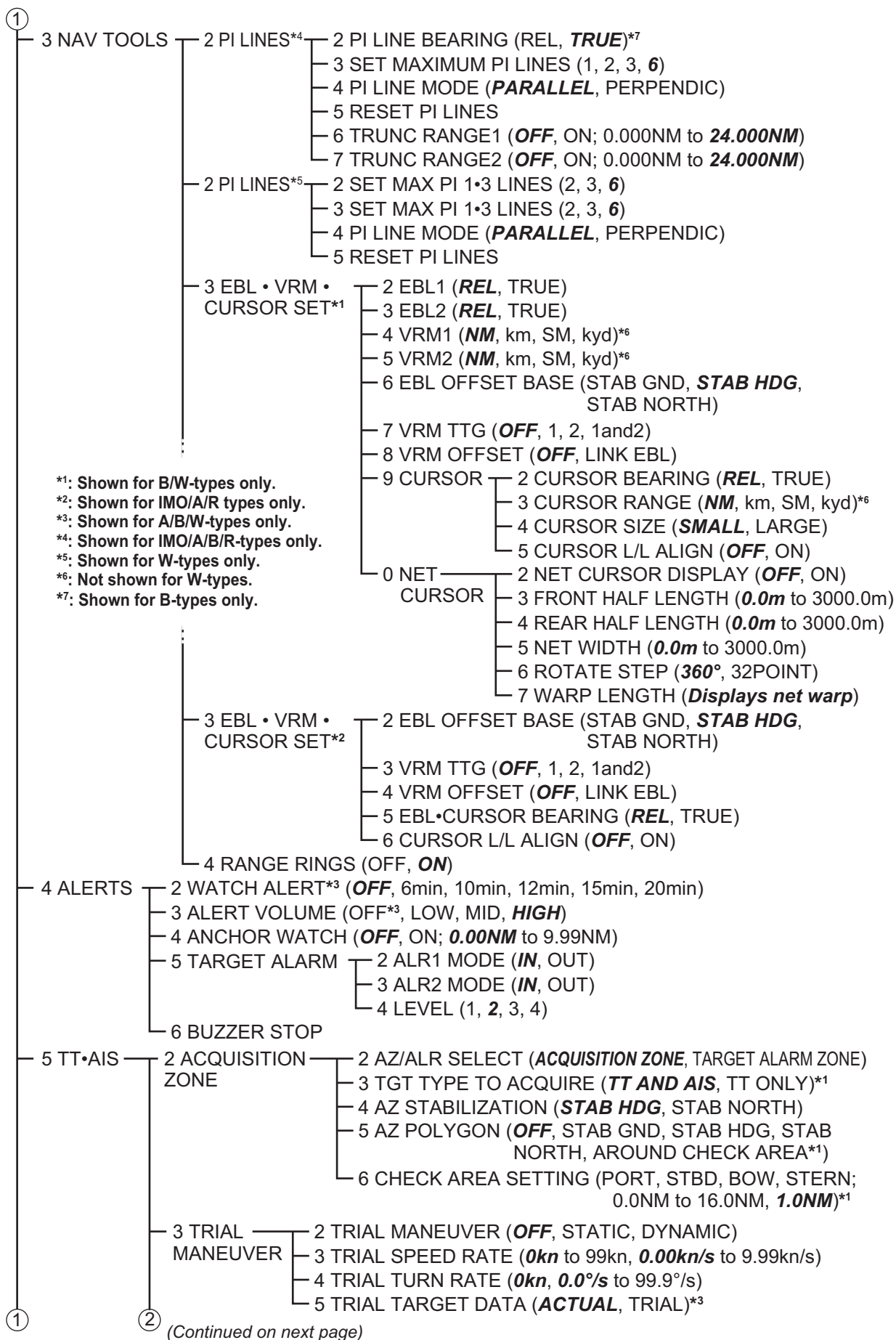


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*¹: Shown for A/B/W-types only.*²: Shown for B/W-types only.*³: Shown for A/B/W-types with Radar Plotter functionality only.



*1: Shown for B/W-types only.

*2: Shown for IMO/A/R types only.

*3: Shown for A/B/W-types only.

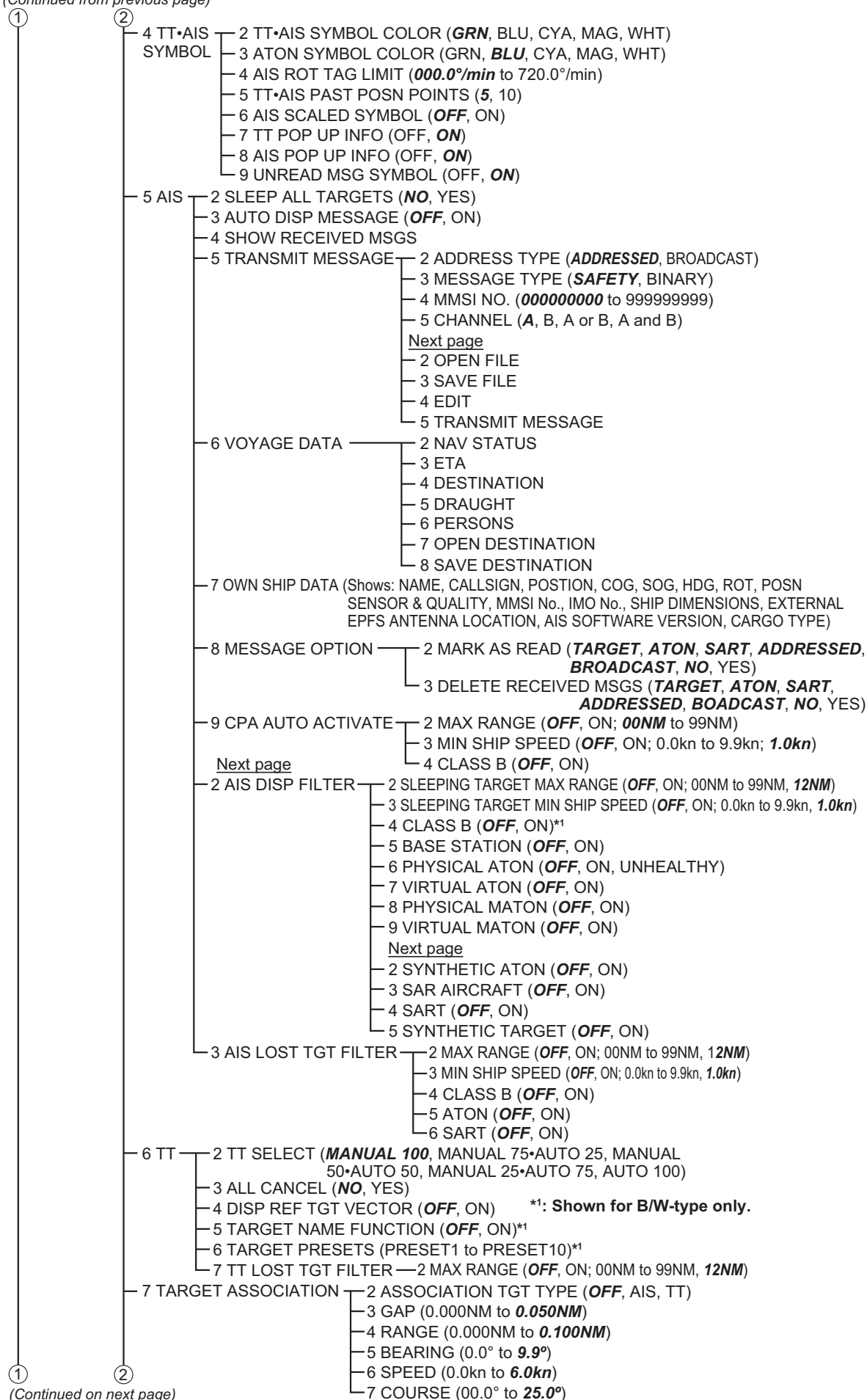
*4: Shown for IMO/A/B/R-types only.

*5: Shown for W-types only.

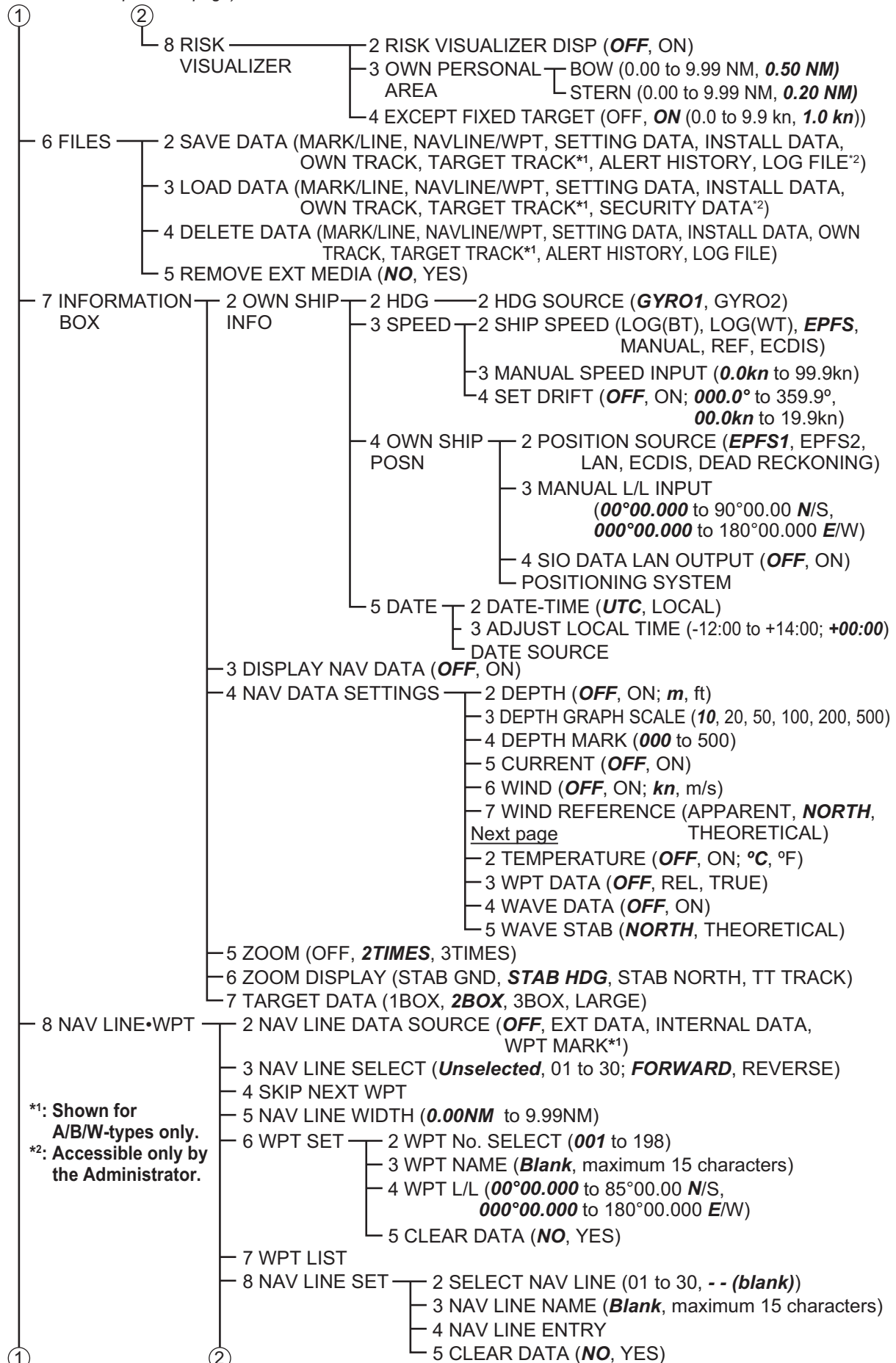
*6: Not shown for W-types.

*7: Shown for B-types only.

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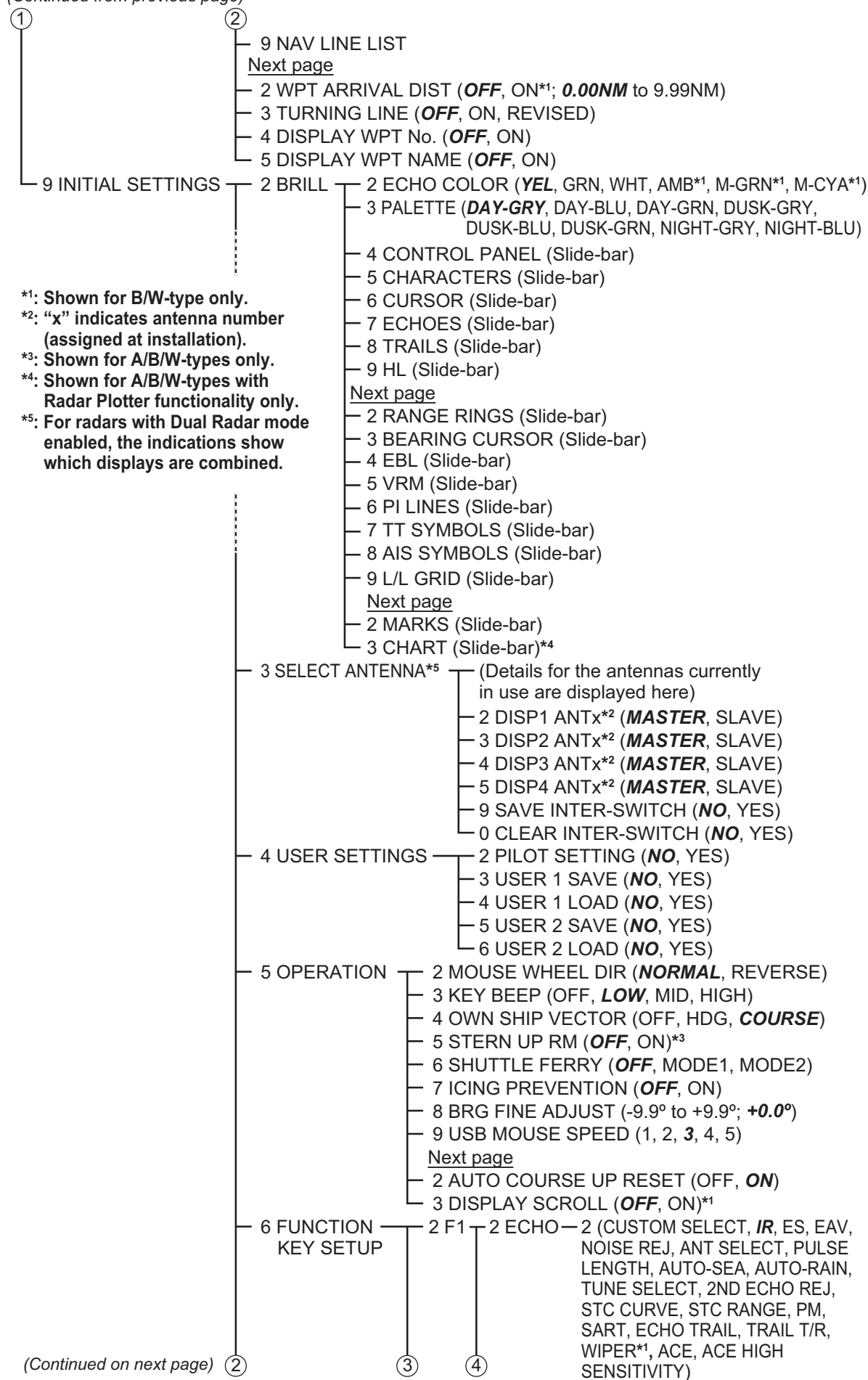
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*1: Shown for A/B/W-types only.
*2: Accessible only by the Administrator.

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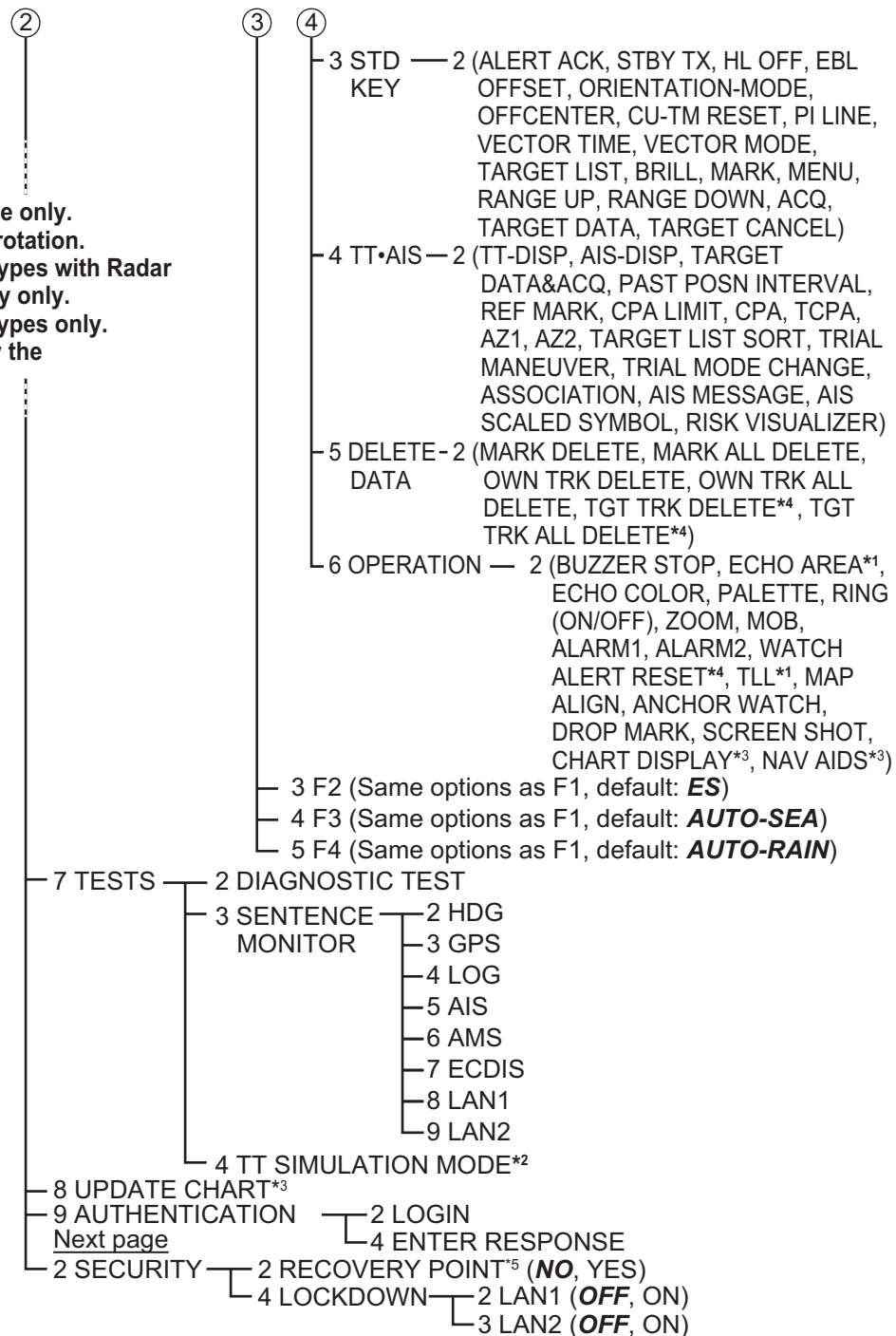
*1: Shown for B/W-type only.

*2: Requires antenna rotation.

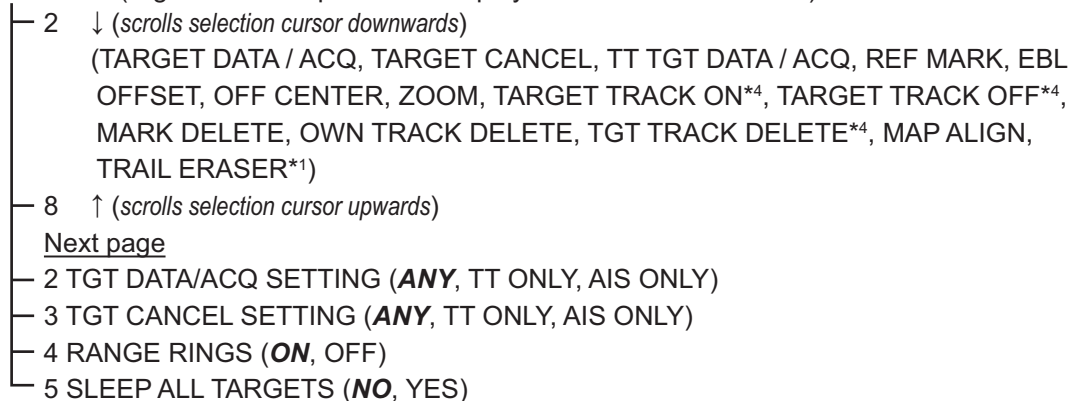
*3: Shown for A/B/W-types with Radar Plotter functionality only.

*4: Shown for A/B/W-types only.

*5: Accessible only by the Administrator.



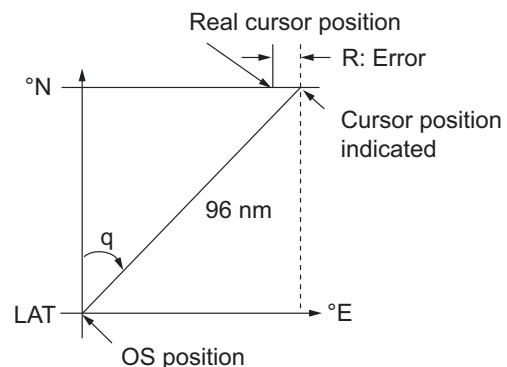
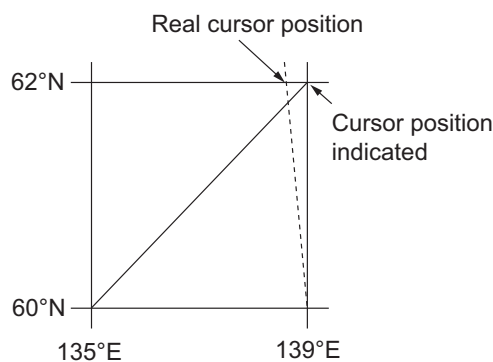
CURSOR MENU (Right-click the operational display area to show this menu)



APPX. 2 LONGITUDE ERROR TABLE (96 NM SCALE)

The longitude lines concentrate on the north pole and south pole, namely, 1 nm is equivalent to 1 minute at 0 degree latitude, 2 minutes at 60 degrees latitude, 3 minutes at 70 degrees latitude and so on. For this reason, a longitude error occurs on the radar display.

For example, when own ship is at 60°N and 135°E, even if the cursor indication is 62°N and 139°E, the real cursor position is deviated to the left (west) side. The table below shows the longitude error, represented from 0° to 90° at 96 nm from the radar center (own ship).



(nm)									
LAT \ q	5°	10°	15°	20°	25°	30°	35°	40°	45°
75°	0.2256	0.4444	0.6496	0.8350	0.9950	1.1248	1.2202	1.2786	1.2980
70°	0.21980213	0.43290201	0.632803	0.8134132	0.96923215	1.09551918	1.1884382	1.24517456	1.26402037
65°	0.21229339	0.41810678	0.61115946	0.78556318	0.93600295	1.05790007	1.14755221	1.20224625	1.22034042
60°	0.20316898	0.40012949	0.58486463	0.75173456	0.89565021	1.0122297	1.09793265	1.15016811	1.16737294
55°	0.19249832	0.37910698	0.55411863	0.71218478	0.84848102	0.95885565	1.03998717	1.08933651	1.10552105
50°	0.18036264	0.35519924	0.51915545	0.66721485	0.79485438	0.89818413	0.97406698	1.02021439	1.03525547
45°	0.16685429	0.32858822	0.48024119	0.61716701	0.73517843	0.83067689	0.90076355	0.94332783	0.95711098
40°	0.15207608	0.29947644	0.437672	0.56242216	0.66990732	0.7568477	0.82060477	0.85926197	0.87168229
35°	0.13614047	0.26808546	0.39177186	0.53339693	0.59953781	0.67725844	0.73420069	0.76865661	0.77961957
30°	0.11916876	0.2346542	0.3428901	0.44054055	0.52460545	0.59251483	0.6422089	0.67220131	0.68162348
25°	0.10129001	0.19943707	0.29139874	0.37433139	0.44568053	0.50326182	0.54532952	0.57063015	0.57843983
20°	0.08264056	0.16270211	0.23768966	0.30527334	0.36336372	0.41017869	0.44429984	0.46471615	0.47085389
15°	0.06336208	0.12472888	0.18217162	0.23389198	0.27828148	0.31397386	0.33988878	0.35526538	0.35968447
10°	0.04360137	0.0858064	0.12526714	0.16073056	0.19108136	0.21537949	0.23289096	0.24311083	0.24577764
5°	0.02350833	0.04623087	0.0674093	0.08634588	0.10242699	0.11514595	0.1241207	0.12910605	0.13000029
0°	0.00323737	0.0063035	0.00903844	0.01130406	0.01299309	0.01403609	0.0144058	0.0141187	0.01323356